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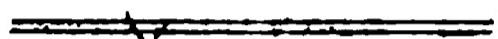


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Brighton and Hove Natural History
and Philosophical Society.



ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY.

TOGETHER WITH THE

ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 8TH, 1898.



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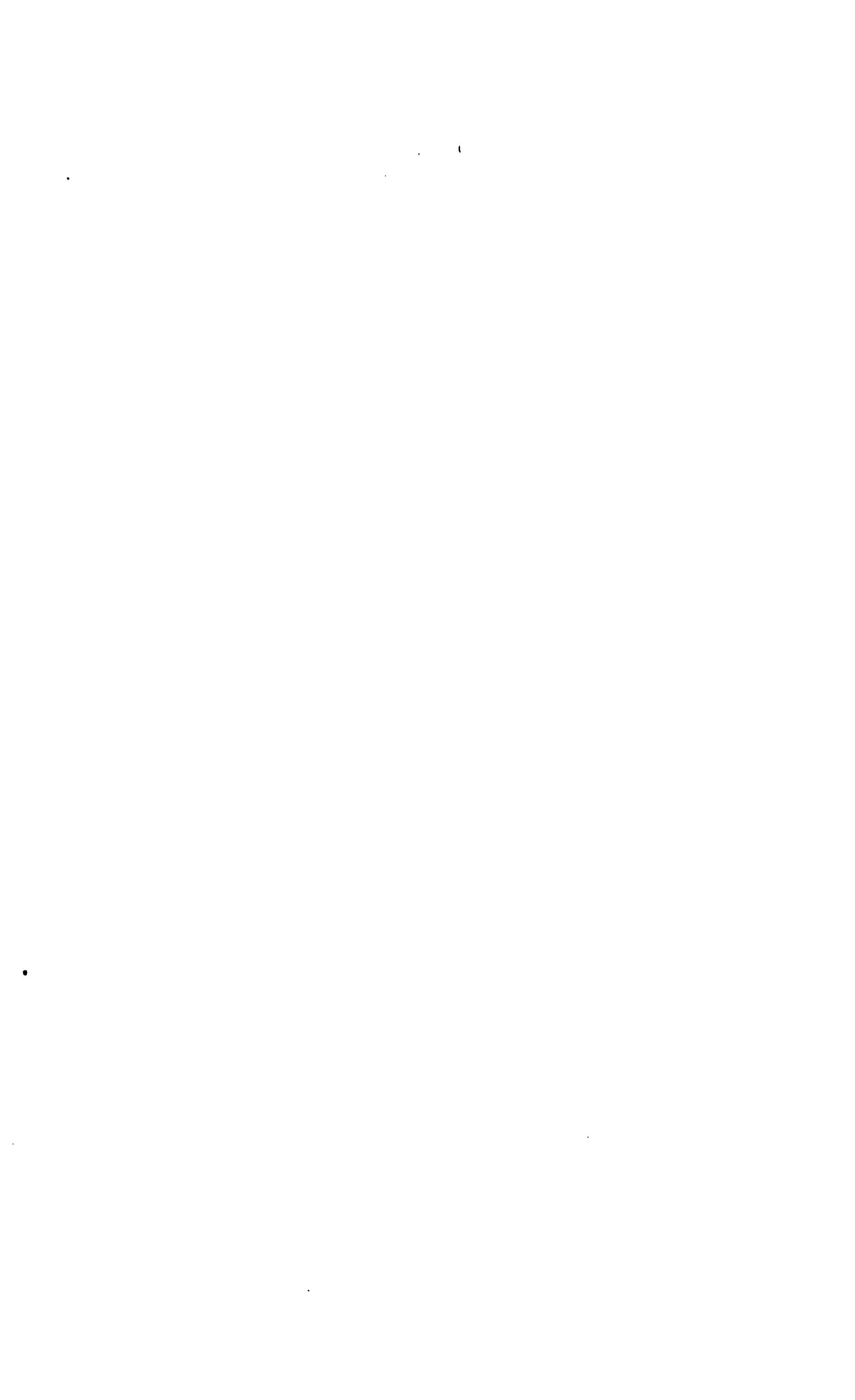
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WEDNESDAY, OCTOBER 13TH, 1897.

INAUGURAL MEETING.

ADDRESS BY

PROF. G. S. BOULGER, F.L.S., F.G.S.

ON

THE VALUE OF FIELD WORK IN NATURAL HISTORY.

The ways in which field work is of value in the study of Natural History may be arranged and discussed as follows :—

1st.—As an incentive and introduction to the study of natural history.

2nd.—As providing necessary *material*.

3rd.—As the study of structural detail.

4th.—As the study of the life of the individual.

5th.—As the study of Hexicology.

1st.—It has been said that Gilbert White's *Natural History of Selborne* has made as many naturalists as Southey's *Life of Nelson* has made sailors.

The mind that is in no degree inquisitive can hardly be in any high degree intelligent ; and the inquisitive mind whether of child or adult can hardly fail to find in any country walk material upon which to exercise itself. Professor Boulger described at some length the more noticeable phenomena which winter, spring, summer and autumn successively display to the dweller in the country. Continuing, he said that so valuable did he believe field work to be as an *incentive* that if any old established Natural History Society finds that it is falling off in numbers he should certainly recommend it to hold field meetings with informal *al fresco* lecturettes, and to try and get visitors as yet untouched by the enchantments of nature to attend such meetings. This would not only be the best means of

recruiting, but it will be at the same time the best introduction to the study of Natural History. The beginner is at once brought into contact with facts and not with mere brain-cobwebs of theory. He deprecated that *collecting*, which sometimes results in the pride of possessing some rare birds' eggs, rare plants or rare minerals—a taste which too often tends to the extermination of beautiful species among our flora and fauna. At the same time it must be said that every great naturalist, from Aristotle to Darwin, had been a collector, and if the young collector can be taught by the older members of a Field Club to observe scientifically and accurately, so as to learn how to identify species and the methods by which they are differentiated, instead of merely affixing a label to certain objects with the name inscribed on it, then collecting will become a scientific education.

2nd.—As to field work as a means of providing material for study, there was not much to be said. The Professor, however, emphasized the need of noting the manner in which the object collected is associated with others. A fragment of rock, for instance, may be analysed by the petrologist, but the knowledge of the mass of rock with which it is associated, or if an igneous one, with those with which it is brought into contact, will often be of service in determining the method of its genesis. Was it taken from the surface, from the sides where it was in contact with other rocks, or from the interior of the mass? If a fossil, there are many seemingly trivial details as to how and where it was obtained, which may be of the utmost value in determining its history.

3rd.—The study of structural detail. The chief feature which renders the late Professor Babington's *Manual* one of the most educational books to put into the hands of a student of Botany is, that so many little points of structural discrimination are brought out which are not recognisable in mere dried specimens. In the study of these difficult but interesting series of forms, for instance, the aquatic or 'Batrachian Ranunculi,' it is of great importance to note whether the segments of the submerged leaves when withdrawn from the water collapse or spread out, and the most recent German authorities on flowering plants insist strongly, in several parts of their system, on the hairs on the plant and the direction in which they grow, as a character of value.

4th.—The study of the life of the individual. Using the terms life and development in a wide sense, we may say that field work is of the very highest importance as a means of studying the life history of individuals in all their phases of

development. It is true we may cultivate fungi in our laboratories, or higher plants in our gardens and greenhouses: snakes will lay and hatch their eggs in captivity, and many animals can be most conveniently studied as they develop in our aquaria; but field work in many cases saves us all trouble; shows us various organisms growing, not in an artificially isolated, but in a natural condition, and shows us the life history of others which we should find it difficult to cultivate or domesticate.

5th.—Hexicology. Perhaps the most valuable of all the features of field work is that teaching of hexicology—natural environment—which it alone affords. To observe plants or animals living together in a natural state, struggling for existence, individual against individual, species against species, each more or less dependent upon others in that marvellous order which we term the “balance of nature,” is to learn lessons in natural history which we cannot receive in the botanical or zoological garden, still less in the laboratory, museum, or library.

Symbiosis, or the mutual dependence of organisms, presents many problems to the observer of the very highest importance. There is the partial dependence of certain plants, such as our sundews and butterworts on some kind of animal life for their nitrogenous food, and there is also the more remarkable case of flowers, like some of our orchids, specially modified for the visits of certain special groups of insects, whilst the legs and other parts of insects are reciprocally adapted for the collection of honey or pollen from these special types of flowers.

Professor Boulger then proceeded to point out other directions in which additional field work is required. Those who live in the country may in the course of a series of years arrive at very precise and valuable results by observing the exact dates of the arrival of our migrant birds, of the hatching of new insect broods, of the unfolding of the leaves of the different kinds of trees, of the opening of particular species of flowers. He then proceeded to quote a passage from Sir A. Geikie's *Field Geology* emphasizing the opportunities which a ramble in the country affords for a study of the soil and the rocks, and pointing out what great problems may be solved by the intelligent observation of the common and familiar phenomena of nature, and went on to say: To these passages I will only add a few practical suggestions of my own. It is probable that Tilgate Forest or other parts of the not very distant Wealden area has still further reptilian spoils to yield to the worker who will follow in the footsteps of Mantell; whilst it is certain that much detailed work

remains to be done in unravelling the conditions under which both Wealden and Lower Greensand beds were formed in different parts of their outcrop. The last word has not been said either on the formation of flint and of flints, or on that of combes and pipes in the chalk or of your own Elephant Bed, and an immense amount of work is urgently needed on the zones of the chalk with special reference to the distribution of foraminifera throughout the series.

If I know of abundance of geological work still crying out for field-workers, I am aware of even more, I think, waiting to be done in Botany. The distribution of sea-weeds bathymetrically and geographically along our coast, and almost everything anent their methods of reproduction, await the attention alike of those who dredge, of those who confine their attention to the shore, and of the microscopists. Still more imperfect is our knowledge of the fresh-water algae, whilst there is, I believe, nothing known at all as to their distribution in the various river drainage systems and estuaries of the county. Whilst algae are readily preserved and furnish such beautiful herbaria that their study has long been graced by the many ladies who have been attracted by it, the study of fungi has, no doubt, suffered from the fact that they are mostly somewhat difficult to preserve, besides being often only too casual and transient in their occurrence. While, however, the smaller and microscopic forms, most of which are parasitic, the rusts, mildews and moulds, and that marvellous isolated group the Myxomycetes—about all of which our knowledge of species, of their life histories, and of their distribution, is most imperfect—afford material for the microscopist, and more especially for the micro-photographer, or the draughtsman with the *camera lucida*; there are methods of preserving the larger forms, such as that described by the late James English: water colour drawings by competent artists are often capable of being specifically identified; and even a “nature-print” of the gills, traced in their own spores, which any one can take with a little gum and some black blotting paper, may be a valuable record. There is no more enjoyable a form of autumnal natural history ramble than a fungus foray, whether followed by experiments on the esculent qualities of the group as adjuncts to more substantial viands, or not. Few who have not collected are aware of the wide range of colour and beauty of outline presented by the numerous species: it is only in a very few long-worked localities such as Epping Forest and the neighbourhood of Hereford that we have anything like a knowledge of the variety of species that may occur; and even in these areas several species new to science, or at least new to

Britain, are yearly added to the list. With such works as Stephenson's *Fungus-Flora* for the higher and Massee's for the lower forms, Dr. Cooke's works, Mr. Worthington Smith's sheets illustrative of the edible and poisonous kinds or with the little guides to the Sowerby Models or to the Myxomycetes in the Natural History Museum, it is not difficult for anyone with ordinary botanical training to identify most of his finds.

Unlike the collectors in most other classes we need not be trammelled, I think, with any fear of exterminating rare species; and assuredly there are plenty of problems as to life history, influence of weather, chemistry of colour and of alkaloids, and physiological action, awaiting the researches of those who contemn mere species hunting. If the members of our various field clubs would only work out the distribution of the fungi of their own immediate districts, noting their manner of occurrence, as to soil, shade, weather, food, etc., this is just one of the subjects in which most valuable results could be obtained over a wide area, by the communication of local lists, confirmed, where possible, by verified specimens, to the central mycological research committee of a union of Societies.

Sussex, since the days of William Borrer of Henfield, has had a fair share of resident critical botanists, and the long residence of Mr. Mitten at Hurstpierpoint will not, perhaps, have left many novelties to be gleamed among mosses and their allies; nor are the dry soils and climate of south-eastern England favourable to fern life; whilst it is among the more conspicuous flowering plants that most observations have been made in this, as in all other districts. Nevertheless, though the work of the late Mr. Roper was fairly complete for the Eastbourne district, there is still much to be done for the county generally, and, I think, for this immediate district, even in phanerogamic botany. The question how far the distribution of species is determined by the chemical character, as apart from the moisture of the soil, and how far it follows watersheds in a comparatively low lying area such as this, is by no means completely answered as yet, nor, perhaps, are we likely to get much reply to it of a satisfactory character, until the more critical genera, such as brambles and roses, have been carefully worked. Here, too, again, in addition to those distributional phenomena which in my opinion form the special province of field clubs, there is at least as great a variety of problems concerning development, comparative anatomy and physiology awaiting solution or further elucidation as in any other division of the vegetable kingdom. Many flowering plants are partly parasitic or saprophytic, or are accompanied with that

mycorhyza to which I have already referred. Abnormalities constantly occur in a wild state, and still more in our gardens, which may throw important light upon structure, and often in this way suggest modifications in our classifications. Besides those familiar physiological topics that were illuminated by the work of the last years of Charles Darwin, climbing, carnivorousness, and the wide field of pollination, with the subsidiary subject of hybridism, there is the most important series of questions as to how far certain cases of apparently parallel development among plants living under similar conditions are indicative of real affinity, or community of descent, or how far they are merely adaptational, how far they may be directly produced by the stimuli of external conditions, or how far, if so acquired, their characters can be hereditarily transmitted. To this question, which lies at the very root of the controversy between Weismann and the Neo-Lamarckians, it seems rather as if at present botanists were disposed to give an opposite reply to that of most zoologists.

There are many groups of animals, such as earth worms and spiders, and I may, perhaps, add marine worms, leeches and crabs, which have only one or two men in the whole kingdom devoted to their study, and which yet are handy enough for any of us to study, and would throw as much light upon the fundamental problems of biology as any of the more popular groups. Our land and fresh water mollusca present interesting questions as to distribution with reference to soil and the hardness of the water.

Passing on to the Arthropoda, Huxley's *Crayfish*, Miall's *Cockroach* and Lowne's *Blowfly*, together with such works as those of Lubbock and Packard seem to specially invite us to a detailed study of comparative anatomy and development, whilst the complex symbiotic conditions of bees, ants, ichneumons and gall flies equally attract us in the direction of pure observational study of the life histories of living insects. There is plenty to be done in the intelligent collecting and study of the micro-lepidoptera, and, even among the too commonly collected macro-lepidoptera, such ubiquitously abundant species of the cabbage-whites and the common blue present most interesting series of variations in size and marking, which seem, at least in the latter case, to be connected with geographical range. Other groups, such as the Diptera, Hymenoptera and Coleoptera, have as yet few workers devoted to them in any district; and, whether in the discovery of new species, the working out the distribution of those already known, the tracing of food-plants, or other points in the life history, offer abundant promise of valuable results.

There are, I believe, few field clubs in whose Transactions can be found even a list either of the dragon flies, or of the grasshoppers of the district. Coming to vertebrate animals, I would suggest that something is wanting to our knowledge of the life history of our smaller fresh water and marine fishes.

Birds, like butterflies, have many collectors ; but here, too, there is room for a more scientific basis for observations. The beautiful cases in the Natural History Museum, South Kensington, suggest the many questions of variations in a wild state, seasonal variation in plumage, sexual divergence in successive moultings, and protective resemblance of eggs or of plumage, and the recent application of the telescopic camera to this purpose by the Messrs. Kearton and others, shows us a new and valuable means at our disposal for the observation of nesting and other habits.

In conclusion, I wish to say a few words as to the conditions which are essential to the value of all field work, and how they can best be maintained. The conditions are briefly, accuracy and system. In all recorded facts in natural history it is primarily essential that there shall be as little doubt as possible as to the species concerning which the facts are recorded. In that compilation, therefore, of local lists, which is the peculiar work of Field Clubs—work in which many members should co-operate—it is most desirable that specimens should be preserved in a local museum, and that, before publication, any groups in the least degree critical should be referred to a competent specialist. It is, be it remembered, only when observations are multiplied that we can obtain those statistical averages which are of so much higher value than merely isolated observations, and an average generally increases in value in proportion to the number of items from which it is drawn.

Among the differences of condition under which it is desirable that our observations should be made, those of position are, I think, of the highest importance to local field naturalists. Be it merely records of the thermometer, barometer and rain gauge, or the occurrence of a plant or animal, the questions of altitude above sea level, distance from the sea, direction of exposure, nature of soil or of surrounding vegetation, and relation to river drainage systems may be of the highest importance. To eliminate merely seasonal fluctuations, or those which are produced by the total differences of climate in one year compared with another, it is necessary that most of our observations should be continuous or repeated from time to time. Thus, for instance, we may become aware of secular changes in the level of land and

water, or in climate; and thus the deplorable extinction of our flora and fauna, by agriculture, drainage, building and over-collecting, may be traced from year to year.

Accuracy and system, then, are the two characteristics which distinguish scientific from ordinary knowledge.

But it is desirable also that the results we have ourselves obtained should be compared with the observations of others. Hence the necessity for conferences between the Secretaries of Societies such as this, so that schedules of questions to be answered may be prepared, and forms drawn up for the tabulation of results, and opportunities be afforded for the discussion of methods and research. Hence the advantage by these Unions of Natural History Societies, under a limited number of which I hope soon to see ranked all the Field Clubs of the land.

MONDAY, NOVEMBER 15TH.

AT THE LECTURE HALL OF THE Y.M.C.A., 55, OLD STEINE.

**BACTERIA IN RELATION TO HEALTH
AND DISEASE.**

**ILLUSTRATED BY LANTERN SLIDES OF THE MORE IMPORTANT
MICROBES,**

including those concerned in important Processes of Nature, in Trades and Manufactures, and in the Production of such Diseases as Typhoid Fever, Diphtheria, Tuberculosis, Tetanus, &c.

BY

DR. ARTHUR NEWSHOLME

(Medical Officer of Health for Brighton).

THURSDAY, DECEMBER 10TH, 1897.

**THE ROSEN COLLECTION OF HORNS
IN THE BRIGHTON MUSEUM.**

BY

MR. B. LOMAX, F.L.S

WEDNESDAY, JANUARY 12TH, 1898.

1897.—A SCIENTIFIC RETROSPECT.

BY

MR. EDWARD ALLOWAY PANKHURST.

THURSDAY, FEBRUARY 10TH, 1898.

(IN THE ART ROOM, MUNICIPAL SCHOOL OF ART.)

SOME POLYZOA OF THE COAST

(ILLUSTRATED BY LANTERN SLIDES).

BY

DR. H. S. GABBETT (OF EASTBOURNE).

The paper, which was illustrated by a number of photomicrographs shown by the lantern, described the characteristics and affinities of Polyzoa in general, and gave a detailed account of the structure of the following species, common on the coast of the neighbourhood :—*Oriisia Eburnea*, *Diastopora Patina*, *Idmonea Serpens*, *Flustrella Hispida*, *Membranipora Pilosa*, *M. Lacroixii*, *Flustra Foliacea*, *F. Papyracea*, *Cellaria Fistulosa*, *Oellepora Pumicosa*, *Mucronella Coccinea*, *Microporella Ciliata*, *Scrupocellaria Scruposa*, *Bugula Flabellata*, *Bicellaria Ciliata*.

Special attention was directed to the appendages of the Polyzoon colony,—spines, vibracula, “birds’-head bodies,” and oecia ; and many photographic illustrations were exhibited. The paper concluded with a brief account of the minute structure and functions of the tentacles, alimentary canal, and muscular system ; and photomicrographs were shown, representing various diatoms which form a large part of the food of polyzoa, and which are constantly found in the stomachs of these animals.

THURSDAY, MARCH 10th, 1898.

(IN THE ART ROOM, MUNICIPAL SCHOOL OF ART.)

ANCIENT EGYPT.

BY

MR. W. CLARKSON WALLIS.

The lecture was illustrated by lantern slides, and also by a large collection of objects obtained in Egypt by Mr. Wallis.

Ancient Egypt is a land of special interest to us, not only from the familiarity we had with it from our earliest days by means of the Scriptures, but also by the completeness with which we were able to realise the history of the life of those far-off ages. So wonderfully had the climate and soil of that country assisted in the preservation of records, that nowadays we were able to picture for ourselves all the varied features of a civilization that had long passed away. For the present age, it was a land of expectations; we never knew what we were going to discover next. Fragments of Homer and of sacred literature had been found, and, for all that we knew, surprises of an extraordinary and deeply interesting nature might be in store. There was no reason why explorers should not come upon some ancient copy of the Scriptures that would do much to settle troublesome controversies. Talking about the geography and geology of Egypt, Mr. Wallis said that it was essentially the land of the Nile. That wonderful river was, indeed, the "river of the water of life;" it was Hapi, "the father of gods, Lord of sustenance who giveth life, who banisheth want and filleth the granaries." The early history of Egypt went back many thousands of years, far beyond what had generally been accepted as the limits of historic time. The early inhabitants were lost in the mists of a prehistoric period. In historic times they found a mixed race in the land. The monuments proved that there were four distinct types,—the negro, the Lybian, the Asiatic, and the Punite, which last developed into the dynastic race. Mr. Wallis made reference to the peculiar race also found in Egypt, who, so far from mummifying their dead and preserving the bodies with scrupulous care, actually devoured the flesh, not for food, but as a special mark of honour. Passing over the mythical period of

Egyptian history and its fantastic legends of gods and demi-gods, Mr. Wallis mentioned the first king of whom we had any definite knowledge as Menes, the founder of Memphis, whose date was about 4,800 B.C. Khufu, the builder of the great Pyramid, came in the fourth dynasty, a thousand years later. It was in this dynasty, so far removed from the present day, that the arts of Egypt reached their highest point. Subsequently they were never surpassed in grandeur, simplicity, and power. In the fifth dynasty was found a singularly high level of understanding, as evinced by the precepts of Ptah-hotep, which revealed a high perception in abstract thinking and morality. Fifteen hundred years passed, and the rule in Egypt was usurped by the Hyksos invaders, or "shepherd kings," of whom very little was known, and who were probably the kings visited by the Hebrew patriarchs. Egypt reached its summit of glory as a power in the world in the reigns of Thothmes I. and Thothmes III., who carried their armies victoriously to the Euphrates, and far into Asia, who built the mighty temples that even now are the wonder of the world, and under whom the country attained its greatest wealth and prosperity. Later on came the stirring periods of Rameses I., Seti I., and Rameses II. Mr. Wallis spoke of the famous campaign of Rameses II. against the Hittites, of which a particularly graphic account was written by the Poet Laureate of the day, l'entaur. According to this, the oldest epic poem in the world, Rameses rallied his disheartened armies, dashed single-handed into the hosts of the Hittites,—evidently no mean adversaries,—and aided by his god Amen, slew them in thousands. The result of the battle was a treaty, still preserved, which was the first diplomatic document known to history.

Turning to the religion of the Egyptians, Mr. Wallis described it as difficult to form any definite idea upon it, owing to the vast mass of material. Whilst there were certain great leading features that remained unchanged from the earliest times, the religion as a whole was an accretion, the component parts of which were derived from many sources and during long periods of time. These additions often bore no relation to each other, and, therefore, involved the most extraordinary contradictions and discrepancies. Deities which were universally worshipped held positions widely different in importance in different localities, and in fact, frequently were varied essentially in their attributes. In, later times, particularly in the Ptolemaic period, attempts were made to systematise the confused combinations by sorting them into trinities, a process that subsequently led up to the idea of

the unity of all the gods. Professor Maspero and Professor Petrie held that the Egyptian idea of the Deity had nothing in common with our modern monotheism. This assertion seemed somewhat difficult to reconcile with the expressions that occurred in many of the hymns, even of the earliest times. In texts of the fifth century many expressions occur which ascribe attributes to the Deity which entirely distinguish him from the lesser gods. In later dynasties the attributes of the sole God became associated with the god Amen, and though it was true that Amen was originally only a local god, yet it was not impossible to believe that the idea of the Neter gradually centred itself into a name. The sun was his symbol, and his cognomen became compounded as Amen-Ra. To prove that he was not regarded as a material sun, Mr. Wallis quoted from the Egyptian "Book of the Dead," and he made reference to the same remarkable work in demonstrating other arguments. From the attributes of this god set forth in such texts, Dr. Brugsch and others had come to the conclusion that the dwellers in the Nile valley from the earliest times knew and worshipped one God, nameless, incomprehensible, and eternal. If words meant anything, it was clear that the Egyptian priesthood (if not the laity) held abstract ideas of the Divine Being, and that, whether or not he was known by different names in different cities, the conception was of a God who was one "besides whom there is no other." That expression actually occurred in a hymn. Amongst the smaller gods were Nu, the representation of the primeval watery waste; Nut, the female principle of Nu, and who was the heavens; Ptah, the creative principle; Khepera, a form of the rising sun which was both a type of matter which is on the point of passing from inertness into life, and of the dead body which was about to burst forth into a new life in a glorified form. The God was typified by a beetle, or scarabæus, and thus it was that scarabæi were found so numerously in tombs. The lecturer also gave the legends concerning Osiris, the God of the underworld, the Lord of Eternity, the Judge of the Dead, and the type of what the dead hoped to become, telling how the evil principle (Set) dismembered him, how Isis recovered the lost fragments, and brought Osiris to life again. Osiris appeared as the good principle at war with the evil, and, through his sufferings, he became the victor and the saviour of mankind.

Regarding the ideas of the Egyptians concerning themselves, Mr. Wallis pointed out that they considered each human being as comprising three portions; there was the body, which was

liable to decay, but which, believing that it would be wanted some day, they took such care to preserve; then there was the spiritual body, which was lasting and incorruptible; and thirdly, there was the heart, which was the seat of the power of life, and the fountain of good and evil thoughts. Besides these somewhat corporeal elements were others less tangible. There was the mysterious Ka, or double, supposed to be the vital principle. It was believed that it could not exist by itself, and hence were made the statuettes found so numerously in tombs. The idea was a curious one, namely, that the Ka stretched itself around these images, which were made like the dead person, in the same way that a glove fits to the hand. The Ka did not stay always in the tomb, but had the power of going out, through a mock door painted or carved in the wall. A significance was also given to the soul; to the shadow; to the Khu, or intelligence, or "the shining," a kind of halo that was supposed to emanate from the person; to the form; and even to the name. As to the future of the soul, the "Book of the Dead," some of which went back in age to the first dynasty, gave long details of the passage through the dim regions of the dead, guarded with animal-headed deities, the dread ordeals, the weighing in the balances, and the final judgment. For the good soul, it was promised that it should exist for "millions and millions of years," "in heaven by the side of God in the most holy place," and texts were found such as "My soul is God, my soul is eternity," or "Soul to heaven, body to earth." In conclusion, Mr. Wallis said that Egypt had had the greatest of influence upon the world; an influence that, in many channels, had come down to us, and remained with us at the present day.

THURSDAY, MARCH 24TH.

LECTURE IN THE DOME

BY

MR. F. COURTENEY SELOUS,

ON

TRAVEL AND ADVENTURE IN SOUTH
AFRICA

(WITH LANTERN ILLUSTRATIONS).

This lecture, it was explained by Mr. J. P. Slingsby-Roberts, in introducing Mr. Selous, was one of a series by which

the Society aims at extending its influence beyond its immediate membership. It was the first time in the history of the Society in which they had ever met in the Dome. As for the subject of the inaugural lecture, he thought nothing could be more appropriate, for the eyes of the world were at present to a great extent fixed on South Africa. He referred to Mr. Selous as one of the most able and energetic of those pioneers who, in distant lands had "scorned delights and lived laborious days" in order to make England great.

Mr. Selous had an enthusiastic reception on rising to relate, as he put it, a few of his experiences in hunting in the interior of Africa. Speaking in an easy conversational manner, he described the state of things existing in South Africa in 1871, when he first landed there, and attributed the vast progress since made to the far-seeing statesmanship and splendid enterprise of Mr. Cecil Rhodes. There was then only one short line of railway between Cape Town and a neighbouring village in the whole of South Africa, and his journey from the coast to the diamond fields in a bullock van took him two months. His object, he explained, was not to seek diamonds, but to get into the interior, where he hoped to find wild game in abundance, be unhindered by fences or rails, and see no objectionable notice boards intimating that trespassers would be prosecuted.

HUNTING ADVENTURES.

He entered Matabeleland in August, 1872, and obtained permission to hunt elephants from Lobengula. In 1874 he visited the Victoria Falls on the Zambesi, and in 1877 crossed the Zambesi, and penetrated far into the country beyond. He travelled for months together without seeing a white man. For three years, he said, he saw no newspaper, or telegram, or any kind of money; and what was more singular, he was perfectly happy without any of these things. He travelled and shot, and with the ivory purchased whatever was necessary for himself and the natives who accompanied him in his expeditions. The greater part of Mr. Selous's lecture, however, was taken up with a description of an adventure in the remote interior, when his camp was raided at night, and he was put in great peril by the treachery of the natives. He escaped with his rifle and only four cartridges, but lost his weapon the following day by a further act of treachery on the part of the natives he had thought friendly, and had to wander alone 200 miles through the bush, making the best of his way by night, and hiding by day, till he met the remnant of his party in the Zambesi Valley. Of the twenty-

three with him in the camp, twelve were missing, and five wounded. During the latter part of the evening, Mr. Selous exhibited on a large screen a number of limelight views, illustrating incidents of his hunting expeditions. In most of these, lions played a prominent part, but one picture showed the hunter in great peril from an elephant, and in another he was seen almost slaughtered by a savage buffalo. There were also some views of African scenery, the most remarkable being a series of pictures of the Victoria Falls, and some pictures reminiscent of the Matabele campaign.

WEDNESDAY, APRIL 13TH.

PARASITISM

(WITH LANTERN ILLUSTRATIONS).

BY

MR. D. E. CAUSH, L.D.S.

Many, perhaps most, animals, even some of the smallest, take in lodgers and boarders. This fact in natural history is prettily summarised in a familiar couplet :—

“ Big fleas have little fleas upon their backs to bite ‘em,
Little fleas have lesser fleas and so ad infinitum.”

Mr. Caush said that these companionships were so general both in the animal and vegetable world that the difficulty was to know where to start in talking about them. If size were made the test, then in the vegetable world they had parasites varying in size from the minute bacteria on which Dr. Newsholme discoursed so ably before the Society a short time since, of which it would require some millions to cover a square inch if laid side by side, to the tropical parasitical plant whose flower will measure from two to three feet across when expanded ; or we may form some idea of their size by examining the giant trees of the tropical forest killed by the ever-twining stems of these parasitical plants. If they confined themselves to those living upon insects or animals, they had a range from the infinitely small to those five or six feet long human parasites, who live upon their fellow men, by begging, borrowing, or by their specious “ Spider and Fly ” like advertisements of “ Money to Lend,” &c. It was not, however, of this

latter class, the worst of all parasites, that he proposed to speak. Nor could colour be taken as a test of classification, as the colours were as varied as the colours of the rainbow. Nor could the defining line be that of usefulness or otherwise ; for, before they had travelled far, they would founder on some all-important but hidden rock. He proposed to confine himself by the aid of photomicrographs to some of the better-known varieties of parasitic insects. The first division had been aptly termed "lodgers." The lodgers make use of their host as a dwelling-place, sometimes using the host for a short time only, and then vacating the establishment for one more suited to their requirements. Amongst this large group may be found the barnacles attached to the skin of the whale ; or the sea anemone, who frequently prefers the shell of the hermit crab, or shells of similar character, to that of a more solid basis, so that its diet may be varied by its being carried to pastures ever new. Again, we have a very large number of sponges, as well as a number of tube worms, who attach themselves to inhabited shells of various kinds. In this latter case we may look upon the tube worms as permanent lodgers, as, prior to building their establishment, they make the foundations very firm upon the surface of the shells they intend to reside upon. Many also of the polyzoa are to be found amongst this class, as was well illustrated by Dr. Gabbett in his interesting lecture lately delivered before this Society ; whilst, if time would permit, a very great variety may be enumerated as living under similar circumstances, examples of which may be found upon our beach with each receding tide, or in the pools amongst the rocks at low water. The second group were not only "lodgers," but also "boarders" in the truest sense of the word, expecting their host not only to supply apartments, but also a liberal table. These all breathe oxygen, and it may be interesting here to see the wonderful provision of the Great Creator in their elaborate breathing apparatus. Though they have mouths and many of them are provided with powerful lancets and marvellous pieces of apparatus for the purpose of feeding, they do not use their mouths for breathing purposes. In the insects themselves there are no true lungs, but wonderful pieces of apparatus whereby the air is circulated over the body. Thus we find scattered all over the body a number of minute openings, frequently covered by fine hairs, which have the power of moving so as to prevent any objectionable substance passing into the openings. These openings are known as spiracles and are the true breathing pores of the insect. On dissecting one of these we find connected with

these spiracles a large number of perfect spiral tubes composed of elastic tissue, and passing into and all over the body of the insect, branching and radiating so that the air may be conveyed to every part; to these the name of tracheæ have been given. We also find that most of them pass through four stages: The egg; the larvæ; the pupæ; and, lastly, the perfect insect.

Mr. Caush then went on to exhibit a number of slides of aphides, acari, pediculus, and pulex. As the views were shown Mr. Caush commented upon the structure and habits of the different classes of parasites shown. Some startling details were given as to the rate of multiplication. For example, the pediculus develops from the egg in five or six days very much like the adult, and in eighteen days they are able to reproduce their kind. Thus in two months two females with their offspring can produce the small family of ten thousand.

WEDNESDAY, MAY 11TH.

(KING'S APARTMENTS, ROYAL PAVILION.)

PROTECTIVE MIMICRY AS EXHIBITED IN MAMMALS.

BY

DR. LOUIS ROBINSON,

Author of "Wild Traits in Tame Animals."

At the outset let us consider what is meant by Protective Mimicry. All of us who have paid any attention to natural objects in our walks in the country must have noticed how remarkably many insects and other creatures resemble their natural surroundings. It is by no means easy to see a grasshopper among the grass, or a green caterpillar in the cabbages. In the tropics many and marvellous instances are found of creatures which exactly resemble dead leaves, bits of stick, lumps of lichen or moss, or even worm castings and the droppings of birds. If these are instances of protective mimicry, no question could arise as to the prevalence of protective mimicry among the mammalia, for we find plenty of instances of warm blooded four-footed beasts resembling their environment.

One of the most striking of these, perhaps, is that of a species of sloth which hangs and browses upon the trees in Central and Southern America. These trees are festooned with great masses of pendant moss which cling closely round branches and stumps of branches coming out from the larger trunks. Some naturalists remarked that although these sloths are of the same green colour as certain masses of tree moss, they appear to be rendered conspicuous by a large brown mark upon the back. This, however, is only when the sloth is removed from its natural environment, for it is found that when they are at home upon the trees, the brown patch upon the back gives an almost exact imitation of a stump of a broken branch.

Our common ground animals, such as rabbits, weasels, and field mice, are usually of the same neutral colour as the half dry grass and leaves among which they hide themselves. The dappled skins of fallow deer so exactly resemble the appearance of light falling through a chequered curtain of leaves upon the ground, that it is often difficult to observe them. The stripes on the tiger so resemble the grass and the shadows between of the tropical jungle, that even the most experienced eyes are constantly deceived. Spotted leopards and tiger cats which inhabit the woods may hide with impunity among foliage where any large animal of uniform colour would be rendered conspicuous.

But all this is not protective mimicry in the sense in which the term is used by naturalists. We speak of such cases as instances of protective resemblance, and I wish to draw, at the outset, a clear distinction between this and protective mimicry, because the origin of the two methods of obtaining protection from enemies are radically different. The term protective mimicry is only applicable when applied to instances in which one living creature so strikingly resembles another of a different species as to be readily mistaken for it. Protective mimicry differs from protective resemblance to surroundings in that it is based upon the desire to be conspicuous, and not upon the desire to be inconspicuous. Now, let me say before I go further that, in using words and phrases such as "mimicry," "desire to be inconspicuous," and so on, the naturalist does not mean that these humble fellow creatures of ours make any endeavour, either conscious or unconscious, to be like their neighbours. It would be perfectly futile if they did. If we rational folk by taking thought cannot add one cubit to our stature, still less is it likely that a butterfly could voluntarily make itself like a wasp, or a spider like an ant or a beetle. The phenomena with which we are dealing are merely the outcome of natural

laws, and the living organisms are merely the counters in Nature's great game. We find it difficult, however, to avoid using terms which seem to imply intention and design both on the side of the moulding forces and the creatures subjected thereto.

In order to understand protective mimicry aright, you must first pay attention to what naturalists speak of as warning colouration. A long time ago it excited surprise among students of nature that some of the very feeblest of living beings, instead of hiding away from their enemies, in accordance with the general rule, flaunt their conspicuous colours abroad in the most bare-faced and reckless manner. When Darwin was studying the colours of animals, he at one time was in danger of being led away by enthusiasm for one of his pet theories. This was the theory of sexual selection. He found that many birds put on gay plumage in the spring, and that male and female butterflies seemed to seek one another because of their brilliant colours. But at the time when he was inclined to attribute most bright colours found among animals to the needs of courtship, he was somewhat taken aback on finding that certain caterpillars, who resemble angels in one particular, in that they do not marry or are given in marriage, were in the habit of wearing very marked and conspicuous attire. He wrote to his great coadjutor, Alfred Russell Wallace, about the subject, and got the reply that in all probability it would be found that birds refuse to eat conspicuous larvæ because they have some nauseous taste or smell, or some other property which renders them unfit for food. I must quote you a few words of Darwin's reply to Wallace's communication. He wrote :—" You are the man to refer to in a difficulty. I never heard anything more ingenious than your suggestion, and I hope you may be able to prove it true. That is a splendid fact about the white moths, and it warms one's very blood to see a theory thus almost proved to be true " Now Wallace, in conjunction with his other great colleague, Henry Walter Bates, did prove this theory to be true ; and it is a striking illustration of how one discovery in science often at once leads to other discoveries even more brilliant, that from these observations sprang our knowledge of the marvellous facts of protective mimicry. We now know, without need of experiment, that a weak and conspicuous animal which makes no attempt to hide itself, is almost certainly inedible to the birds, lizards, etc., which are in the habit of preying upon insects. There are certain striking exceptions to this rule, and as these exceptions form the very subject of this paper, we must by no means ignore them.

These exceptions are the creatures which have so mimicked

their nauseous and conspicuous neighbours as to be mistaken for them by insectivorous foes. I am not enough of an entomologist to be able to pronounce with confidence some of the imposing Latin names of the butterflies mentioned in works dealing with protective mimicry. Let it suffice, then, to say that Bates discovered in Northern Brazil several kinds of conspicuous butterflies which were so much alike as to deceive even a skilled entomologist, yet which were found upon close examination to be in no way related. Bates found that it was only their conspicuous parts which had become altered so as to produce resemblance. In their hidden and internal parts they each conformed to the structure of their own proper section of the insect world. Further investigation proved that wherever such likenesses existed, one species was usually more numerous than others, and moreover possessed certain qualities which rendered them unfit for food, and fairly secure from attack. . . . I have said that these conspicuous, and at the same time nauseous, and otherwise formidable creatures profit by their bold advertisement. It is not difficult to see where the gain comes in. We are all acquainted with the proverbs. "Once bit, twice shy," and "A burnt child fears the fire." Now a bird which had once had a painful experience in trying to eat one of these acrid insects would hesitate about attacking another exactly like it. The insects, if one may so speak, make themselves as disgusting as possible and proclaim the fact they are intolerably nasty by every means in their power.

In studying the subject of mimicry it has been found necessary to divide it into two sections. One deals with protective mimicry in which insects and other animals, themselves edible, gain immunity from attack by resembling those which are nauseous; the other with aggressive mimicry, when the semblance of another creature is adopted, not for the sake of escaping enemies but for the sake of preying upon the victims of deceit.

To this latter class belong certain flies which almost exactly resemble humble bees, and which steal into the nests of the latter and lay their eggs in the bees' nursery, so that the larval flies, when hatched, commence to dine upon the young bees without going far in search of their food. Another instance, to which attention was drawn by Mr. and Mrs. Packham, the American naturalists, to whom we owe the distinction between protective and aggressive mimicry, is that of a spider which assumes the exact shape of an ant, so that he may prey upon the small beetle, which is one of the ant's domestic animals.

You may search all the museums and nearly all the books in the world and you will find that scarcely a single instance has been brought forward, even by way of suggestion, of protective mimicry among mammals. The one case quoted in Beddard's book on *Animal Colouration* is that of a tree shrew which inhabits certain of the East Indian Isles, and which has a very close resemblance to a black squirrel of about the same size, plentiful in the same regions. In the Natural History Museum of South Kensington you will find the two animals mounted side by side, and certainly the resemblance is very close. Moreover, the shrews are an eccentric and versatile race, and would, therefore, be more likely to exhibit protective mimicry than many other families of mammals. It appears probable that this is an instance of aggressive rather than protective mimicry, for squirrels are as a rule vegetarians, and, therefore, their presence would not alarm the insects and other small deer which inhabit the branches when they are constantly passing to and fro.

Now let us consider for a moment why it is that protective mimicry is not more common among the comparatively highly organised mammalia. There are, I think, three principal reasons.

One is that the mammalia are comparatively very much more modern than the more lowly organised insect population, and therefore possibly they have not had time to evolve such elaborate artifices to escape from their foes.

Secondly, that the danger which most mammals have to guard against is of a very different character from that which threatened the butterflies and other insects. The latter are preyed upon almost exclusively by insectivorous birds and reptiles. One might say, indeed, that nearly all the shifts resorted to by lepidopterous mimics are expressly for the sake of deceiving the eyes of birds. Now mammals are probably more preyed upon by their fellow mammals than by any other destructive agent, and these warm-blooded enemies seldom, like the birds, trust to a single sense, namely, that of sight in detecting and securing prey.

Nearly all the mammalians have an elaborate olfactory apparatus and ears, which not only hear the slightest sound, but, owing to the movable external ear trumpet, worn by nearly all mammals, are able to detect the direction from which it comes. Moreover, generally speaking, mammals are more intelligent than birds or reptiles, and can draw better conclusions from the evidence of their senses. It would be of little use for a hare, escaping from a pack of hounds, to resemble some creature which dogs hold in abhorrence; nor would a field mouse, whose

movements among the rustling dry grass, betray its whereabouts to a cat, gain much by mimicing some creature ignored or dreaded by all felines.

The third reason why protective mimicry is comparatively rare among mammals, is because warning colourations are distinctly rare among the higher animals; and we have seen that most cases of protective mimicry are founded upon definite warning colouration. It is true, there exist one or two marked cases of animals which exhibit warning colours. The skunk, as pointed out by Wallace, and also by Belt, the brilliant author of the *Naturalist in Nicaragua*, is a very conspicuous object when among his natural surroundings, and usually makes no effort whatever to get out of the way. But as an example of mimicry, the skunk is as one crying in the wilderness, "born to blush unseen, and waste his sweetness on the desert air." A few other animals, such as the gorilla and certain squirrels, seem also to display warning colouration, but I am not aware that in a single case has the hint been taken by any feeble creature.

Are we, then, to confess that mimicry is practically unknown among mammals? and must I sum up my paper in a manner similar to the Irish naturalist historian, who devoted a separate chapter to snakes, consisting merely of the words, "There are no snakes in Ireland"?

Personally, I do not think so; and I am about to submit to you several cases which, I think, cannot otherwise be regarded than as instances of protective mimicry. The books which deal with protective mimicry not only confine their attention almost exclusively to insects, amphibia, and reptiles, but seem to deal as exclusively with resemblances calculated to deceive the eye. Most of the cases which I shall submit to your notice appear to be attempts to deceive other senses.

You are all aware of what takes place when a dog thrusts his nose among a nest of young kittens. Although the tiny creatures can scarcely see, and have had no experience whatever to guide them, they hiss and spit at their hereditary enemy the instant their sense of smell reveals his presence.

Moreover, you will observe that the dog almost always seems startled and taken aback by this curious demonstration of hostility. Now, Nature does nothing in vain, and whenever the habit is found to be constant in all members of the species you may be pretty sure that it is not there by chance, and that at some time it was of considerable value in saving the race from extinction.

If we push our inquiries further, we find the case of the kitten is by no means an unique one. Bats, both old and young, hiss and explode when you explore their holes, so do many birds, such as wood-peckers, titmice, horn-bills and owls, young opossums and phalangers and dasyures manifest the same habit, and a striking example is found in South America among the nyctipitheci, or night apes, an eccentric family of monkeys about which I shall have something further to say if time permits. Now all these hissing creatures, although as you will see at once they belonged to all sections of the animal kingdom, have a common habit of making their nurseries in hollow trees or shallow holes. My suggestion is, here we have clearly the mimicry of the hiss of the snake.

Dr. Robinson went on to say that for an instance of protective mimicry they had to look no farther than the tabby cat on the hearthrug,—he meant the pure tabby,—with large black curved markings. When the cat was curled up asleep those markings formed a spiral, strongly suggestive of a coiled serpent, with a full blotch where the head would be. In the same way margays and ocelots resembled rattle snakes and pythons. He wished them to consider this theory entirely as an open question ; it would amuse them even if they did not believe it. His idea was that these animals resembled snakes for their own protection. These markings might be mere vestiges of what existed in former days, when the mammals were feeble creatures, as compared with the great birds and reptiles from which they needed special protection. If the varying species retained the same common trait, it might be said that the trait was peculiar to the original type. The cat's near relatives, like the civet and the genet, also had these longitudinal markings along the back ; and there again they got the resemblance to the coiled serpent. The lecturer also drew attention to the viperine appearance of cats when enraged. There was the suggestion of the fangs, and the movement of the tail was snake-like, for snakes when angry jerked their tails to and fro, very much as cats did. The striped tail of the cat, too, had a curious snakelike aspect. He did not say that the resemblance in the case of an enraged cat was very strong, but it would be sufficient to give an enemy a shock and enable the cat to get an advantage. The cat, moreover, uttered sounds very much like those emitted by venomous snakes when about to strike. Their sibilant utterances might generally be regarded as an ultimatum. Cats were the prey of the eagles, but many eagles feared and avoided snakes. He admitted that many difficulties stood in the way of the theory he

had advanced, but they diminished by examination. Jaguars and tigers hissed, and, though it might be thought that such powerful animals did not need the protection of this mimicry of serpents, yet the hissing was probably a survival from the early days when, as he had said, mammals were comparatively feeble creatures, living in a world that swarmed with gigantic birds and reptiles. Almost all animals had a dread of snakes, and he believed that the habit of hissing and spitting had been evolved, in imitation of snakes, as a protection against the mammals' instinctive dread of serpents. As an illustration, the lecturer cited the hissing of kittens and owlets in their arboreal nurseries, the idea being to give the predatory intruder, who thought he had smelt kittens, the impression that the nest in the hollow of a tree was occupied not by kittens but by snakes. He had said nothing so far about the mimicry of snakes by birds, though it would be perfectly easy to employ nearly a whole evening in such illustrations. Take for example the gander, which stretched out its snake-like neck and hissed. The Muscovy duck made the same noise, and the habit was extremely common amongst almost all birds that nested in the reeds by the river side. And not only did they hiss, but they thrust out their necks in a style similar to that of the ganders. This would probably be enough to intimidate a carnivorous creature that might approach. One other instance was that of the little night apes of South America, which made a hissing and spitting noise when anyone approached the entrance to their homes in the trees. Finally, the lecturer said he believed that a large field of investigation awaited someone in connection with this question of protective mimicry amongst mammals.

At the conclusion of Dr. Robinson's Paper, one was read on

THE SEAMEW'S PROVIDER.

BY

MR. ERNEST ROBINSON.

"Why do the 'Clinton Hounds', as the shepherds in the neighbourhood of Brighton call Seagulls, come in-shore for food when the land is fast bound in frost and other birds are drifting to the coast?" This, said Mr. Robinson, was the question which had crossed his mind and had puzzled him for years. All earth-worms (which appear to be the only prey the gulls take inland), should be well below the frost, except a few dry, brown specimens which were caught on the surface by the first sudden frost,

and this hill has been drawn too many times by the pack of Chinton Hounds to leave the least chance of such a find remaining. He now thought that the mystery had been solved, and wrote this article to explain his theory. While crossing an arable field high up on the Sussex Downs during a frost—a place where, after a shower on a summer evening, one may count thirty earthworms to the square yard, and the ground seems to vibrate as they quickly draw in their bodies at the sound of a footstep—he noticed one of the species suddenly eject the greater part of its length from its burrow, and writhe as if in extreme agony.

On taking hold of the creature and withdrawing it from the hole, he found that an insect resembling a centipede had firmly attached itself to the worm's lower extremity. It was armed with a formidable pair of forceps, and so deeply were these embedded in the body of the unfortunate worm that being carried suspended for some half mile did not cause it to relinquish its hold.

The aggressor and its victim were deposited together in a box of earth, and on examining the contents next morning the worm was found to be in two portions, which, contrary to the popular belief that each part will form a complete annelid, were both dead.

That this creature is the seagull's provider, by driving the worm above ground within its reach, was the theory suggested by this little episode, and on mentioning it to other naturalists, he was recommended to shoot a few gulls, and endeavour to prove it.

The last day before the protected season for these birds arrived without a specimen being obtained, although large flocks had frequented the district, when about midday he noticed a number of gulls crossing a hillside, and, hastily taking his gun, made for a deep lane over which the flock was passing, in time to stop one of the rearguard.

The bird, a fine specimen of the common gull, dropped without moving a wing. A *post mortem* was made, and on searching the gizzard it was found empty, with the exception of a few clover leaves and nodules of chalk, and he wondered if the object of his search would be found without the slaughter of ten or twelve of these beautiful birds, but, examining the abdominal cavity towards the gullet, a soft substance was discovered, and he drew forth an earth worm, and, still attached thereto (although both were dead) a little brown, centipede-like insect, and, with recollections of my Euclid days, *quod erat demonstrandum* escaped my lips.

In the first instance, Mr. Robinson thought that the specimen was a true centipede, and was confirmed in this idea by an authority to whom it was submitted, but after a time he began to suspect that both were wrong.

On the first really warm day of the season the seagulls disappeared ; no doubt their nesting time had come, but he had a strong suspicion, proved by E. T. Booth in the case of gannets, that many sea birds, and also starlings and rooks, do not nest as yearlings. If this is so, some of these would surely have stayed, if the worms were still driven to the surface.

He purposed capturing a few of the so-called centipedes, which are often turned up by the plough, and by keeping them hungry, exhibit their voracity on some unfortunate earthworm at this meeting of the Brighton Natural History Society ; but search was fruitless, and it occurred to him that some gentlemen who had seen a specimen, and hinted that it looked very much like the larva of a beetle, were right in their conjecture, and that the creature had now passed into the pupa stage of its existence.

Being in the neighbourhood of Kensington last week, he took the opinion of the Curator of the Insect department of the Natural History Museum on the specimen, and after careful examination it was stated to be the larva of some member of the family Carabidæ.

Much interest was exhibited in its carnivorous habit, and Mr. Robinson was told that comparatively little is known of the life history of the carabid beetles.

As additional proof of this theory it may be added that on dissecting a Redwing thrush which had been shot in frosty weather, there were found in the gizzard remains of both earthworm and beetle larvæ.

If the carnivorous larvæ drove the earthworm above ground to fall a prey to the birds without injury to itself, there might be danger of the extermination of a very important factor in the world's fertility, as Darwin tells us of the momentous part that the worm plays in the formation of vegetable mould ; but as the seamew devours both aggressor and victim the balance of power is not likely to be disturbed, and a meal is provided for the hungry in a season of scarcity.

THE FOLLOWING VALUABLE
 LIST OF WEALDEN AND PURBECK-
 WEALDEN FOSSILS,
 HAS BEEN COMPILED FOR THE SOCIETY
 BY ITS HONORARY MEMBER,
 CHARLES DAWSON, F.G.S., F.S.A., UCKFIELD,
 JUNE, 1898.

ABBREVIATIONS.*

- H..... Hastings—Wadhurst clay; Ashdown; Fairlight clay.
- Ck. ... Cuckfield—Upper Wealden Beds.
- I. of W. Isle of Wight— " "
- Br. ... Brightling } —Purbecks.
- P..... Pounceford } —Purbecks.
- Cw. ... Cowden; Upper Wealden Beds.
- H.W. Heathfield Railway Station Well (Purbecks reached 353 feet).

* The Fossils from the Cuckfield and Cowden districts belong to the Upper Wealden Beds.

Those from the Hastings district are from the Tunbridge Wells sands, Wadhurst clays and Ashdown sands, and Fairlight clays).

The Brightling and Pounceford specimens are from the "Sussex Purbecks" (or rocks which underlie the Fairlight clays).

The Isle of Wight specimens are nearly all from the Weald clay of Brook Point.

MAMMALIA.—MULTITUBERCULATA.

- Plagiaulax Dawsoni (A.S.W.) H.
- Bolodon sp., Lyd, H.

REPTILIA.—SAUROPTERYGIA.

- Cimoliosaurus valdensis, Lyd, H.
- Limnophilus, Koken, Ck.

CROCODYLIA.

- Goniopholis crassidens, Owen, H., Ck., Br., I. of W.
- Heterosuchus valdensis, Owen, H., Ck., I. of W.
- Suchosaurus cultridens, Owen, H., Ck., I. of W.

Hylæochampsæ vectiana, Owen, I. of W. (H.?).

„ sp., I. of W. (H.?).

Pholidosaurus Meyeri, Dunker, I. of W.

DINOSAURIA.

Hylæosaurus armatus, Mantell, Ck. (I. of W.?) (H. Teeth?).

Iguanodon Bernissartensis Blgr., I. of W., Ck.

„ *Dawsoni*, Lyd, H.

„ *Fittoni*, Lyd, H.

„ *Hollingtoniensis* Lyd, H.

„ *Mantelli*, Meyer, Ck., I. of W.

Hypsilophodon Foxi, Huxley, I. of W., Ck.

Vectisaurus valdensis, Hulke, I. of W.

Pleurocoelus valdensis, Lyd, H.

Megalosaurus Oweni, Lyd, H., Ck.

„ *Dunkeri*, Koken, H., Ck., I. of W.

Aristosuchus pusillus, Owen, I. of W.

Calamospondylus Foxi, Lyd, I. of W.

Morosaurus brevis, Owen, Cw.

Polacanthus Foxii, Hulke, I. of W.

Polacanthus sp., Lyd, H.

Titanosaurus sp., I. of W.

Ornithopsis Hulkei, Seeley, Cw., I. of W. (H.?).

Thecospondylus Daviesi, Seeley, I. of W.

„ *Horneri*, Seeley, Tunbridge.

ORNITHOSAURIA.

Ornithochirus Clavirostris, Owen, Cw., I. of W. (H.?).

„ ? *Clifti*, Mant, Ck.

Ornithochirus Nobilis, Owen, I. of W.

„ ? sp., Lyd, I. of W.

„ ? sp., Owen, Ck.

CHELONIA.

Plesiochelys Brodiei, Lyd, I. of W.

„ *valdensis*, Lyd, I. of W.

Tretosternum sp., Lyd, Ck., I. of W.

Hylæochelys latiscutata, Owen, Br., I. of W.

„ *emarginata*, Owen, I. of W.

„ *Belli*, Mantell, I. of W.

Archæochelys valdensis, Lyd, Ck.

PISCES—ELASMOBRANCHII.

Hybodus basanus, Egerton, H.

„ *striatulus*, Agassiz, Ck.

Hybodus, subcarinatus, Agassiz, Ck.
Acrodus ornatus (A.S.W.) H.
Asteracanthus granulosus, Egerton, Ck., H.

GANOIDI.

Lepidotus, Mantelli, Agassiz, H.
Cœlodus Mantelli, Agassiz, Ck.
 ,, *hirudo, Agassiz, H., Ck.*
Caturus sp. (A.S.W.) H.
Neorhombolepis valdensis (A.S.W.) H.
Belonostomus sp., (A.S.W.) I. of W.
Oligopleurus vectensis (A.S.W.) I. of W.
 ? *Thrissops sp., H.*

INSECTA.

**Coleoptera (elytra of), Tunbridge, Weald clay of Wateringbury, H. (Fairlight clay and Ashdown).*
Neuroptera (elytra of) H. (Ashdown and Fairlight clay).
 (Borings in fossil wood).

CRUSTACEA.

**Estheria elliptica, Dunker, H., T. Wells.*
* ,, *v. subquadrata, Jones, H.*
*i*Cyprione Bristowi, R. J., H., Lindfield.*
*i*Cythere faba, Reuss, H.*
* ,, *sp.*
*i*Metacypris, Fittoni, Mant., Atherfield.*
Cypridea Austeni, R. J., Peasemarsh and Shotover.
 ,, *Phillipsiana, R. J. (Neocomian), Shotover.*
 ,, *verrucosa (var. crassa), R. J. (Neocomian), Shotover.*
 ,, *bispinousa, R. J. (Neocomian), Shotover.*
 ,, ? *leguminella, Upper Purbeck.*
 ,, *fasciculata, E. F., Mid Purbeck.*
 ,, *Purbeckensis, E. F. ,,*
 ,, *punctata, E. F. ,,*
 ,, *cornigera, R. J., I. of W.*
 ,, *candona Mantelli, R. J., I. of W.*
 ,, *Dunkeri, R. J., I. of W.*
* ,, *Fittoni, S., Hythe.*
 ,, *Granulosa (Granulata; Forbes), S., Hythe and Haslemere, and Sub-Wealden Boring.*
* ,, *gyripunctata, R. Jones, Sevenoaks.*
* ,, *tuberculata, E, Forbes, H.; I. of W., Hythe and Haslemere.*

**Cypridea Spinigera*, S., R. J., Uckfield, Hythe and Haslemere
 , " *striatopunctata*, R. J., Hythe.

* , " *valdensis* (C. Faba), S., I. of W., Burwash and
 Lindfield.

Darwinula leguminella, F., I. of W.

ANNELIDA.

Arenenicola, general (worm castings).

MOLLUSCA.—LAMELLIBRANCHIATA.

Cardium, H.W.

**Corbula* sp., Br., Atherfield, Haslemere and Teston.
 , " *oblata*, H.W.

Cyrena, H.W.

* , " *angulata*, Sowerby, S. (and generally)

* , " *dorsata*, Ck.

* , " *elongata*, S., H. (and generally).

, " *gibbosa* (variety of *C. Media*), generally in Weald.

, " *major*, S., generally in Weald.

* , " *media*, S., " "

, " *membranacea*, S. "

* , " *parva*, S., " "

* , " *subquadrata*, H. and Atherfield.

**Exogyra Bousingaulti*, d'Orb, Atherfield.

Ostrea, H.W.

* , " *distorta*, S., Hythe and Atherfield.

**Unio antiquus*, S., Ck., H., Tunbridge.

, " *compressus*, S., H.

* , " *cordiformus*, S., Ck., H., Wheatley and Oxford.

* , " *gualteri*, Mantell, T. Wells.

, " *Mantelli*, S., Ck.

, " *Martini*, S., Ck.

* , " *porrectus*, S., H., Ck.

* , " *Stricklandi*, Phil, Shotover Kill.

* , " *subsimiatus*, H. & D., H.

* , " *substruncatus*, S., H., T. Wells.

* , " *valdensis*, Mant., I. of W., H., Ck.

, " sp., H., Ck.

**Potamomya*.

GASTEROPODA.

Actæon, near T. Wells (Fitton).

Bulla Mantelliana, S., Ck., and near T. Wells (Fitton).

Hydrobia? H.W.

- Melania** sp., H.W., and near T. Wells (Fitton).
 „ *attenuata*, S., H.
 „ *tricarinata*, S., Haslemere.
Mylitus sp? Haslemere.
Neritina, Fittoni, Mant., Ck.
Paludina carinifera, S., H.
 * „ (*vivipara*) *elongata*, S., Outwood and generally.
 * „ „ *fluviorum*, S., H. and generally.
 „ sp.? S., Hythe, Wheatley and Compton Bay.
 ***Tornatella**, H., Southboro'.
 ***Vicarya (melania) strombiformis** Schl., Shipborne, Tunbridge and Atherfield.

PLANTÆ.—THALLOPHYTA.

- Algites** *valdensis*, Sew, H.
 „ *catenelloides*, Sew, H.

CHAROPHYTA.

- Chara** *Knowltoni*, Sew, H.

BRYOPHYTA.

- Marchantites**, *Zeilleri* Sew, H.

PTERIDOPHYTA.

- Equisetites** *Lyelli*, Mant, H.P.
 „ *Burchardti*, Dunk, H.
 „ *Yokoyamæ*, Sew, H.
Onychiopsis *Mantelli*, Brong, H., Ck.
 „ *elongata*, Geyl, H.
Acrostichopteris *Ruffordi*, Sew, H.
Mantonidium *Göpperti*, Ett., H., Ck.
Protopteris *Witteana*, Schenk, H.
Ruffordia *Göpperti*, Dunk, H.
 „ *latifolia*, Sew, H.
Cladophlebis *longipennis*, Sew, H.
 „ *Albertsii*, Dunk, H.
 „ *Browniana*, Dunk, H.
 „ *Dunkeri*, Schimp, H.
Sphenopteris *Fontainei*, Sew, H.
 „ *Fittoni*, Sew, H.
Weichselia *Mantelli*, Brong, H.
Tæniopteris *Beyrichii*, Schenk, H.
 „ *superba*, Sew, H.
 „ *Dawsoni*, Sew, H.

- Sagenopteris** Mantelli, Dunk, H.
 „ acutifolia, Sew, H.
Microdictyon Dunkeri, Schenk, H.
Dictyophllum Römeri, Schenk, H.
Leckenbya valdensis, Sew, H.
Tempskya Schimperi, Cord, H., Ck.

GYMNOSPERMÆ.

- Cycadites** Römeri, Schenk, H.
 „ Saportæ, Sew, H.
Dioonites Dunkerianus, Göpp, H.
 „ Brongniarti, Mant, H.
Nilssonia Schaumburgensis. Dunk, H.
Otozamites Klipsteinii, Dunk, H.
 „ superbus, Sew, H.
 „ longifolius, Sew, H.
 „ ? Reiberioanus, Heer.
 „ Göppertianus, Dunk, H.
Zamites Buchianus, Ett., H.
 „ Carruthersi, Sew, H.
 „ latifolius, Sew.
Anomozamites Lyellianus, Dunk, H.
Cycodolepis Dory—H.
 „ Eury—H.
Carpolithes, sp., H.
Androstrobus Nathorsti, Sew, H.
Bucklandia anomala, (S. and W.) H., Ck.
Fittonia Ruffordia, Sew, H.
Bennettites Saxbyanus, Brown, I. of W., H.
 „ Gibsonianus, Carr, I. of W.
 „ sp., H.
 „ Carruthersi, Sew, H.
 „ latifolius, Sew, H.
Yatesia ? Morrisii, Carr.
Sphenolepideum Kurrianum, Dunk, H.
 „ Sternbergianum, Dunk, H.
 „ ? subulatum, Heer.
Pagiophyllum crassifolium, Schenk, H.
 „ sp., H.
Brachyphyllum spinosum, Sew, H.
 „ obesum, Herr, H.
Pinites Dunkeri, Carr, I. of W.
 „ Carruthersi, Gard, H.
 „ Solmsi, Sew, H.

- Pinites Ruffordi*, Sew, H.
Nageiopsis heterophylla, Font, H.
Thuites valdensis, Sew, H.
Conites (Araucarites), sp., H.
 „ *armatus*, Sew, H.

PLANTÆ INCERTÆ SEDIS.

- Withamia Saportæ*, Sew, H.
Becklesia anomala, Sew, H.
Dichopteris ? laevigata, Phill, H.

There are also two unnamed specimens from Hastings, figured in the British Museum catalogue—by Mr. A. C. Heward, Vol. I., p. xxxv., pl. 1, fig. 7, and p. xxxv., pl. 1., figs. 8 and 9. The latter is probably one of the Lycopodiaceæ.

The following collections in the British Museum contain almost all the type specimens above mentioned ; many of these are exhibited in the drawers of the Museum, and others may be studied on application to the keeper.

- “The Beckles Collection,”
- “The Dawson Collection,”
- “The Egerton Collection,”
- “The Fox Collection,”
- “The Mantell Collection,”
- “The Rufford Collection.”

The following other Museums contain useful specimens for the study of the Wealden fossils :—

- The Brighton Museum,
- The Cambridge Museum,
- The Geological Museum, Jermyn Street, W.,
- The Hastings Museum,
- The Owen's College Museum,
- The York Museum.

Reference should be made to the excellent catalogues now published by the Trustees of the British Museum.

NOTE.—The above list of Mollusca, Crustacea, etc., has been made up from the specimens preserved in the Geological Museum (under the superintendence of E. T. NEWTON, Esq., F.R.S.), and from the lists of fossils given by SOWERBY, TOPLEY, MORRIS, RUPERT JONES, FORBES, ETHERIDGE, and others.

It is right to say that the Molluscs have not yet been properly described, and the large collection in the British Museum is not yet arranged or catalogued. The specimens above named and marked with an asterisk can be seen at the Geological Museum, Jermyn Street, London, W.

A list of the Fossils discovered in the Sub-Wealden, 1872-6 boring, is given in *Dixon and Jones' Geology of Sussex*, p. 160.

METEOROLOGICAL REPORT.

Appended are the customary statistical statements of weather conditions in Brighton for 1897-98. In the two tables the monthly weather is contrasted with the average conditions of the twenty preceding years, and with the corresponding weather in Crowborough. The data for the latter information are derived from Mr. H. Prince's valuable observations.

The chief feature of the year's weather has been the continuance of a very deficient rainfall. This was most marked during the first four months of 1898. The total rainfall of the six months (October and March inclusive) was only 8.2 inches, as compared with an average of 21.1 inches in the twenty-one years, 1877-98. The nearest approach to the deficient rainfall in the six winter months of 1897-98, was in 1879-80, when the amount was 9.5 inches.

ARTHUR NEWSHOLME.

TABLE I.

Month.	Temperature of Air during Month.												Relative Humidity Saturation—100.	
	Highest		Mean		Number of days of Wind.									
	Lowest	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm	No. of days on which rain fell.	No. of sunless days.	No. of hours recorded	
July	1897	82.2	48.8	64.0	61.5	3.4	0.7	2.1	1.9	12.6	5	3	263.29	
	1877-96	85.0	45.0	63.6	74	1	—	2	7	8	6	1	212.94	
Aug.	1897	78.8	52.0	61.6	2.3	4.3	1.4	2.1	1.2	9.8	5.0	4.2	219.76	
	1877-96	82.2	44.3	58.9	58.0	6	3	1	1	1.4	6.8	3.0	4.7	201.29
Sept.	1897	69.0	41.4	58.2	35.2	3.5	0.8	1.1	1.9	1.4	4.7	0.6	4.2	148.51
	1877-96	83.2	38.2	54.3	72	8	6	5	3	5	2	2	2.70	164.11
Oct.	1897	66.0	38.0	51.1	29.5	4.1	7.0	1.4	1.8	1.5	6.4	2	0.38	160.49
	1877-96	73.0	30.0	47.5	51.1	3.0	6.0	1.5	1.5	2.6	2.8	5.1	4.24	121.22
Nov.	1897	60.0	30.0	45.8	45.3	84	5	3	6	4	3	1	1.53	61.75
	1877-96	63.5	17.9	41.4	43.3	84	3.7	6.1	1.2	1.6	2.6	3.2	3.40	73.45
Dec.	1897	55.0	27.2	41.4	45.1	88	6	1	1	1	4	1	1.5	61.75
	1877-96	69.4	17.6	43.2	43.3	87	4	4	4	1.8	7.4	3.6	3.37	74.84
Jan.	1898	54.0	31.0	40.9	39.1	3.7	6.1	1.2	1.6	2.5	5.1	0.5	2.64	54.70
	1877-96	63.6	12.0	41.4	41.4	87	4	4	4	1.8	7.4	3.6	1.5	3.33
Feb.	1898	54.6	27.2	40.9	40.9	81	2.8	5.7	2.0	2.4	6.6	2.5	2.75	60.63
	1877-96	58.0	17.4	41.8	41.8	87	4	4	4	1.8	7.4	3.6	1.5	3.33
Mar.	1898	55.0	28.2	42.2	42.2	81	2	1.3	2	2	6	8	1.96	92.97
	1877-96	65.0	20.2	43.2	43.2	87	4	4	4	1.8	7.4	3.6	1.5	3.33
April	1898	61.0	35.0	43.3	43.3	79	3	8	3	3	5	1	0.92	107.36
	1877-96	75.4	28.0	46.7	46.7	79	2.7	10.3	1.6	2.4	5.2	1	1.81	144.83
May	1898	70.0	36.8	53.5	53.5	78	5	9	2	1	1	1	1.81	167.76
	1877-96	78.1	30.0	53.1	53.1	78	4	8	—	3	5	1	1.81	186.25
June	1898	76.8	42.8	57.6	57.6	78	4.5	1.9	2.3	1.6	9.3	2.6	3.2	146.92
	1877-96	85.0	37.0	59.3	59.3	78	2.8	6.5	1.9	2.3	1.6	0.4	1.79	163.35

N.B.—The Mean Sunshine Records are for the years 1890-98 inclusive only.

TABLE II.

Month.	Temperature of Air During Month.			Highest.	Lowest.	Mean.	Wind.								Rainfall.							
	N.	E.E.	E.W.	S.E.	S.W.	W.	N.W.	W.	S.W.	S.E.	N.E.	N.	No. of days on which rain fell.	Amount collected in inches.								
January, Brighton	60.0	22.8	21.2	44.3	41.3	33.9	33.9	30.2	32.0	31.4	31.8	31.8	21	21	21	21	21	21	21	21	21	
January, Crowthorugh	57.8	21.5	20.5	41.3	41.3	34.9	34.9	31.4	31.4	31.4	31.4	31.4	17	17	17	17	17	17	17	17	17	
February,	64.6	32.0	30.9	44.0	43.9	36.9	36.9	30.9	30.9	30.9	30.9	30.9	20	20	20	20	20	20	20	20	20	
March,	68.4	32.0	31.4	41.3	41.3	35.0	35.0	31.4	31.4	31.4	31.4	31.4	16	16	16	16	16	16	16	16	16	
April,	67.8	31.4	31.8	41.3	41.3	32.1	32.1	31.4	31.4	31.4	31.4	31.4	15	15	15	15	15	15	15	15	15	
May,	65.8	31.8	30.9	41.3	41.3	34.9	34.9	31.8	31.8	31.8	31.8	31.8	14	14	14	14	14	14	14	14	14	
June,	74.6	69.8	69.8	41.6	41.6	46.0	46.0	41.6	41.6	41.6	41.6	41.6	13	13	13	13	13	13	13	13	13	
July,	82.2	82.2	82.2	48.8	48.8	49.2	49.2	48.8	48.8	48.8	48.8	48.8	12	12	12	12	12	12	12	12	12	
August,	79.0	79.0	79.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	11	11	11	11	11	11	11	11	11	
September,	69.0	69.0	69.0	41.4	41.4	37.3	37.3	41.4	41.4	41.4	41.4	41.4	10	10	10	10	10	10	10	10	10	
October,	66.0	66.0	66.0	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	9	9	9	9	9	9	9	9	9	
November,	64.5	64.5	64.5	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	8	8	8	8	8	8	8	8	8	
December,	60.0	60.0	60.0	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	7	7	7	7	7	7	7	7	7	
Crowthorugh	68.8	68.8	68.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	12	12	12	12	12	12	12	12	12	
Brighton	55.0	55.0	55.0	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	11	11	11	11	11	11	11	11	11	
Brighton	52.5	52.5	52.5	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	10	10	10	10	10	10	10	10	10	
Crowthorugh	82.2	82.2	82.2	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	9	9	9	9	9	9	9	9	9	
Brighton	82.2	82.2	82.2	41.4	41.4	37.3	37.3	41.4	41.4	41.4	41.4	41.4	8	8	8	8	8	8	8	8	8	
Brighton	69.0	69.0	69.0	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	38.2	7	7	7	7	7	7	7	7	7	
Brighton	66.0	66.0	66.0	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	6	6	6	6	6	6	6	6	6	
Brighton	64.5	64.5	64.5	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	5	5	5	5	5	5	5	5	5	
Brighton	60.0	60.0	60.0	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	4	4	4	4	4	4	4	4	4	
Crowthorugh	55.0	55.0	55.0	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	3	3	3	3	3	3	3	3	3	
Brighton	52.5	52.5	52.5	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	2	2	2	2	2	2	2	2	2	
Crowthorugh	82.2	82.2	82.2	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	1	1	1	1	1	1	1	1	1	
Entire Year, Brighton	82.2	82.2	82.2	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	21	21	21	21	21	21	21	21	21	
Entire Year, Crowthorugh	82.2	82.2	82.2	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	24	24	24	24	24	24	24	24	24	

Mean Relative Humidity.
Saturation = 100.

Mean relative humidity.

SATURDAY, JUNE 11TH, 1898.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 11TH, 1898.

The records of the Society for the past year show one notable departure from those of previous years. It is in the institution of Lectures under the auspices of the Society, to which the public are admitted on payment.

A Lecture Guarantee Fund was started in the beginning of the year in connection with the scheme, and soon reached a total sum of between two and three hundred pounds. Mr. Selous was engaged, and his admirable lecture in the Dome on "Travel and Adventure in South Africa," was in so far a success that no loss fell on the guarantors. There is little doubt that a considerable amount would have accrued to the Lecture Fund had the weather not been so unpropitious.

Encouraged by the result of this experiment, it is proposed that two or three Lectures shall be given next Session. It is also hoped that a programme of Lectures to be given before the Society, and of papers to be read at its Meetings, may for the first time in the history of the Society be issued before the commencement of the next Session.

The Council regrets that the Meetings of the Sections have not been better attended, but trusts that as their work becomes more widely known, and as the Membership of the Society increases, they will receive more support than has hitherto been accorded to them.

A Meeting of the S.E. Union of Scientific Societies with which this Society is affiliated, was held at Croydon on the 2nd, 3rd, and 4th inst. The Meeting was attended by Messrs. J. P. Slingsby Roberts, Breed, Davey, and Pankhurst, the Delegates appointed by the Council.

They conveyed an invitation from the Council to the Union, inviting it to meet at Brighton in June next year. It appears, however, from their report, that Rochester was selected as the

place of Meeting for 1899, but a hope was expressed that the invitation to visit Brighton would be renewed for the following year, when no doubt it would be accepted.

During the past year the Society has lost three Members by death and five have resigned. Nineteen new Members have, however, been elected, showing an increase in the year of eleven Members.

The following is the list of Excursions—

-
-
- 12th June, 1897, Newick Park.
 - 10th July, " Crowborough.
 - 30th April, 1898, Cuckfield.
 - 14th May, " Chailey Common.
-
-

PHOTOGRAPHIC SECTION.

ANNUAL REPORT.

Chairman : Mr. W. CLARKSON WALLIS.

*Committee : Messrs. J. P. SLINGSBY ROBERTS, DOUGLAS E. CAUSH,
W. W. MITCHELL, W. H. PAYNE, E. J. ELGEE,
and C. BERRINGTON STONER.*

Hon. Secretary : Mr. R. CHAPPELL RYAN, 43, Compton Avenue.

Your Committee have to report that eight Sectional Meetings have been held, and as last year, the attendance has only been fair. Of these Meetings, one was held as a "Members' Evening, for discussion of photographic matters and mutual criticism of prints, etc. Four evenings were given up to the reading of Lantern Lectures, on loan from the Editor, *The Amateur Photographer*; these lectures were mostly instructive in their character. Two evenings were devoted to the exhibition of the *Amateur Photographer* and *Photography* prize slides for '97; these two Meetings were participated in by the Members of the Hove Camera Club. The other evening was occupied by the Hon. Secretary, who gave some hints on "Instantaneous Photography."

The Annual Competition was held in November. Fifty-six prints were sent in and one set of lantern slides; eight awards were made, and these were distributed amongst three of the seven competitors.

The past year has not been marked by any particular event, neither has the scheme for a "Photographic Survey" been forwarded.

The adoption of this report was proposed by Mr. Pankhurst and seconded by Mr. Elgee. Carried.

Signed on behalf of the Committee,

R. C. RYAN,
Hon. Secretary.

BOTANICAL SECTION, 1897.

ANNUAL REPORT.

One Meeting was held, and the Committee and Officers re-elected.

A considerable number of Specimens added to the Society's Herbarium were exhibited, and a vote of thanks passed to the contributors. Cards issued by the Secretary having failed in securing attendance at a later Meeting, there is nothing further to report.

T. HILTON, *Secretary.*

Since last year's Report, the following comparatively rare plants (all gathered in Sussex) have been added to the Society's Herbarium.

Sedum album (White Stonecrop), Fishersgate Cliff.

Medicago minima, Camber Sands.

Trigonella pururascens, Aldrington Beach.

Arenaria tenuifolia, Stanmer Downs.

Silene gallica, a *Anglica*, Telscomb.

Lepidium ruderale.

Cochlearia Anglica, Fishbourne.

Melissa officinalis, Sonthease.

Lamium incisum, Keymer.

Ruppia spiralis, Cuckmere Haven.

Rumex Hydrolapatheum, b. *latifolia*, Lewes.

Rumex acutus, Henfield.

Centaurea solstitialis, Ovingdean.
Hypochaeris glabra, Camber Sands.
Bartsia viscosa, Chailey.
Dianthus prolifer, near Selsey.
Dianthus deltoides, Hassocks.
Hippophæ rhamnoides, Camber Sands.
Epipactis palustris, near Poynings.
Juncus maritimus, Fishbourne.
Setaria viridis, Patcham.
Sisymbrium pannonicum, Brighton.
Bromus secalinus, b. *velutincus*, Pyecombe.
Festuca ambigua, Camber Sands.
Glyceria maritima, Fishbourne.
Carex axillaris, Birdham.
Blysmus compressus, Fishbourne.
Fumaria pallidiflora, Wartling.
Potamogeton trichoides, Iford.
Ballota nigra, var. *ruderale*, Fishersgate.
Lathyrus hirsutus, near Stanmer.
Vicia lathyroides, Camber Sands.
Trifolium glomeratum, Camber Sands.
Delphinium Ajacis, Brighton.
Chenopodium ficifolium, Goldstone Bottom.

REPORT OF THE DELEGATES TO THE MEETING OF THE S.E. UNION OF SCIENTIFIC SOCIETIES, HELD AT CROYDON, ON JUNE 2ND, 3RD AND 4TH, 1898.

We beg to report to the Council that in obedience to its request we duly attended the Meeting at Croydon. On Thursday evening Professor Boulger delivered the inaugural address; on Friday and Saturday papers were read and discussed on different scientific subjects. At the Meeting of Delegates on Saturday morning, the President of this Society, Mr. J. P. Slingsby Roberts, presented the invitation authorized by the Council to meet at Brighton next year, and urged on the Delegates the claims which Brighton had to the honour of a visit. There were certain circumstances, however, connected with Rochester and the

Natural History Societies of that and the adjacent towns which decided the Delegates on choosing Rochester as the place of Meeting for next year. A hope was, however, expressed that the invitation from Brighton would be renewed next year, when no doubt it will be accepted for 1900. As a full report of the proceedings at the Meeting will be sent to the Society, it is not necessary perhaps to enter into further detail with regard to them.

(Signed) J. P. SLINGSBY ROBERTS,
EDWARD ALLOWAY PANKHURST,
H. DAVEY, Junr.,
EDWARD A. J. BEEED.

LIBRARIAN'S REPORT.

During the past year, 96 books and periodicals have been issued on loan, and the library has also been used for reference purposes by the general public. As the Society is now affiliated to the British Association, the valuable Reports of the latter will henceforth be given to our library; and the Report of last year's meeting held at Toronto has already been received. Besides the serials to which the Society subscribes, the only addition by purchase to the library has been Bateson's *Materials for the study of Variation*. The publications of the United States Geographical Survey and Smithsonian Institution are specially valuable gifts. The Society has also to thank Mr. Arthur Griffith for the donation of two volumes of Memoirs, and a number of serials.

HY. DAVEY, Jun.

Brighton and Sussex Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 8th JUNE, 1898.

Dr.	Ct.	£	s.	d.
1898.	To Balance in the hands of the Treasurer, 9th June,	7	10	7
1897	" Annual Subscriptions and arrears to 1st October,	7	12	1
"	" Annual Subscriptions to 1st October, 1898	8	0	0
1897	" Annual Subscriptions to 1st October, 1899	60	0	0
"	" Annual Subscriptions to 1st October, 1899	0	10	0
"	" Entrance Fees...	2	10	0
"	" Associate's Subscription to 1st October, 1898	0	2	6
"	" Amount of Subscription overpaid ...	0	0	6
"	" Dividends on £100 2 <i>1/4</i> per cent. Consolidated Stock, for one year to April, 1898	2	15	0
	" Bookbinding ...	...	
	" Printing Annual Report and Abstract of Proceedings ...	...	
	" Printing and Stationery, General ...	...	
	" Postages, &c., General ...	...	
	" Scientific Secretary, Honorarium for the current year... ...	...	
	" Incidental ...	...	
	" Printing, Expenses ...	...	
	" Fire Insurance Premium on Books ...	...	
	" Balance in the hands of the Treasurer, 8th June, 1898 ...	...	

Balance in the hands of the Treasurer, 8th June,
1893 £100 2*½* per cent. Consolidated
Stock invested in the names of the Hon.
Treasurer and Hon. Secretaries as Trustees for
the Society.

Audited with books and vouchers and found correct.

P. G. CLARK, F.C.A., Hon. Auditor.

September, 1898.

RESOLUTIONS, &c., PASSED AT THE ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was proposed by Dr. MORGAN, seconded by Miss CAMERON, and resolved—

"That the Report of the Council, the Treasurer's statement, the Librarian's Report, and the Reports of the Committees of the several Sections now brought in be received, adopted, and printed for circulation as usual."

It was proposed by Mr. PANKHURST, seconded by Mr. HARRISON—

"That Rule 1 of the Society be altered by substituting the word 'Hove' for the word 'Sussex' in this Rule."

The following amendment was proposed by Mr. E. A. T. BREED, seconded by Mr. H. DAVEY.

"That the name of the Society be the Brighton, Hove and Sussex Natural History and Philosophical Society."

The amendment was put to the Meeting and declared lost.

The resolution was put and declared carried.

It was proposed by Mr. PANKHURST, seconded by Mr. BREED, and resolved—

"That Rule 25 be altered by adding the words 'or other Members after the words 'past Presidents' in this Rule."

It was proposed by Mr. PANKHURST, seconded by Mr. HASELWOOD, and resolved—

"That Rule 49 be altered by adding after the word 'Meetings' the words 'unless otherwise determined by the Council in respect of any Meeting or Meetings, of which determination due notice shall be given.'"

The Secretary reported that in pursuance of Rule 25, the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

"Mr. J. E. Haselwood, Dr. A. Newsholme, Mr. D. E. Caush, Mr. E. J. Petitfour, B.A., F.C.P., Mr. J. P. Slingsby Roberts, and Dr. E. McKellar, Dep. Surg. Genl., J.P.

And that in pursuance of Rule 42 the Council had appointed the following gentleman to be Honorary Auditor—

“Mr. F. G. Clark, F.C.A.”

The Secretary also reported that the following gentlemen who had been elected Chairmen of Sections would, by virtue of their office, be Members of the Council—

“*Photographic Section*: Mr. W. C. Wallis; *Botanical Section*: Mr. J. Lewis; *Microscopical Section*: Mr. D. E. Caush; and that the following gentlemen who are Secretaries of Sections would also, by virtue of their office, be Members of the Council:—*Photographic Section*: Mr. R. C. Ryan; *Botanical Section*: Mr. T. Hilton; *Microscopical Section*: Mr. W. W. Mitchell.

It was proposed by Mr. EDMONDS, seconded by Mr. E. J. PETITFOURT, and resolved—

“That the following gentlemen be officers of the Society for the ensuing year:—*President*: Dr. W. J. Trentler; *Ordinary Members of Council*: Dr. R. Black, Mr. Harrison, Mr. W. W. Mitchell, Mr. Morgan, Mr. Payne, and Mr. W. Clarkson Wallis; *Honorary Treasurer*: Mr. E. A. T. Breed; *Honorary Librarian*: Mr. H. Davey, Jun.; *Honorary Curator*: Mr. B. Lomax, F.L.S.; *Honorary Secretaries*: Mr. Edward Alloway Pankhurst, 3, Clifton Road, Mr. J. Colbatch Clark, 64, Middle Street; *Assistant Honorary Secretary*: Mr. H. Cane.”

The following amendment was proposed by Mr. PANKHURST, seconded by Mr. DAVEY, and carried—

“That Dr. Waring and Mr. J. Lewis, F.S.A., be elected Ordinary Members of the Council in the place of Mr. W. C. Wallis and Mr. W. W. Mitchell, *ex-officio Membera*.”

It was proposed by Mr. J. WELLS, seconded by Mr. HARRISON, and resolved—

“That the sincere thanks of the Society be given to the Vice-Presidents, Council, Honorary Librarian, Honorary Treasurer, Honorary Auditors, Honorary Curator, and Honorary Secretaries for their services during the past year.”

It was proposed by Mr. H. DAVEY, Jun., seconded by Mr. T. HILTON, and resolved—

“That the sincere thanks of the Society be given to Mr. J. P. S. Roberts for his attention to the interests of the Society as its President during the past year.”

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

- British Association, Burlington House, Piccadilly.
- Barrow Naturalists' Field Club.
- Belfast Naturalists' Field Club.
- Belfast Natural History and Philosophical Society.
- Boston Society of Natural Science (Mass., U.S.A.).
- British and American Archaeological Society, Rome.
- Cardiff Naturalists' Society.
- Chester Society of Natural Science.
- Chichester and West Sussex Natural History Society.
- Croydon Microscopical and Natural History Club.
- Department of the Interior, Washington, U.S.A.
- Eastbourne Natural History Society.
- Edinburgh Geological Society.
- Epping Forest and County of Essex Naturalist Field Club.
- Folkestone Natural History Society.
- Geologists' Association.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- Leeds Naturalist Club.
- Lewes and East Sussex Natural History Society.
- Maidstone and Mid-Kent Natural History Society.
- North Staffordshire Naturalists' Field Club and Archaeological Society.
- Peabody Academy of Science, Salem, Mass., U.S.A.
- Quekett Microscopical Club.
- Royal Microscopical Society.
- Royal Society.
- Smithsonian Institute, Washington, U.S.A.
- South-Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- Watford Natural History Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS
OF THE
Brighton and Sussex Natural History and
Philosophical Society.

1897.

N.B.—Members are particularly requested to notify any change of address at once to Mr. J. C. Clark, 64, Middle Street, Brighton.

When not otherwise stated in the following List the address is in Brighton.

ORDINARY MEMBERS.

ATTREE, G. F., 8, Hanover Crescent.

ASHTON, C. S., 3, Chatsworth Road.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.

BURCHELL, E., L.R.C.P., 5, Waterloo Place.

BROWN, J. H., 6, Cambridge Road, Hove.

BADCOCK, LEWIS C., M.D., M.R.C.S., 10, Buckingham Place.

BALEAN, H., 15, Alexandra Villas.

BOOTH, E., 70, East Street.

BABER, E. C., M.B., L.R.C.P., 46, Brunswick Square.

BURROWS, W. SEYMOUR, B.A., M.R.C.S., 62, Old Steine.

BILLING, T., 86, King's Road.

BLACK, R., M.D., 14, Pavilion Parade.

BEVAN, BERTRAND, Withdean.

BREED, E. A. T., 72, Grand Parade.

BECKWITH, C., 114, Church Road, Hove.

CLARK, JOHN COLBATCH, 64, Middle Street.

COX, A. H., J.P., 35, Wellington Road.

CANE, H., 64, Middle Street.

COWLEY, E. R., 12, Stanford Avenue.

CATT, B. W., 44, Church Street.

CAUSH, D. E., L.D.S., 63, Grand Parade.

CLARK, F. G., 56, Ship Street.

COWELL, SAMUEL, 9, Preston Park Avenue.

COUCHMAN, J. E., Down House, Hurstpierpoint.

- DAVEY, HENRY, J.P., 82, Grand Parade.
 DAY, REV. H. G., M.A., 55, Denmark Villas, Hove.
 DEMAN, SAMUEL, 26, Queen's Road.
 DODD, A. H., L.R.C.P., M.R.C.S., 14, Goldstone Villas, Hove.
 DAVEY, HENRY, JUNE., 82, Grand Parade.
 DEEDES, REV. CANON, 2, Clifton Terrace.
 DOUGLAS, F., B.Sc., 14, Clifton Terrace.
- EDMONDS, H., B.Sc., Municipal School of Technology.
 EWAET, SIR J., M.D., F.R.C.P., M.R.C.S., F.Z.S., Dyke Road.
 ELGEE, E., Mountjoy, Preston Road.
- FLETCHER, W. H. B., Fair Lawn House, Worthing.
 FRIEND, D. B., 77, Western Road.
- GROVE, EDMUND, Norlington, Preston.
 GRIFFITH, ARTHUR, 59, Montpelier Road.
- HASSELWOOD, J. E., 3, Richmond Terrace.
 HURST, H., Ship Street.
 HOBBS, JAMES, 62, North Street.
 HACK, D., Fir Croft, Withdean.
 HOLLIS, W. AINSLIE, M.D., F.R.C.P., 1, Palmeira Avenue, Hove.
 HOLDER, J. J., 8, Lorne Villas.
 HAYNES, J. L., 24, Park Crescent.
 HENRIQUES, A. G., F.G.S., 9, Adelaide Crescent, Hove.
 HARRISON, WALTER, D.M.D., 6, Brunswick Place, Hove.
 HODGSON, G. G., M.R.C.S., 35, Montpelier Road.
 HOWLETT, J. W., 4, Brunswick Place, Hove.
 HARDING, N., Wynnstay, Stanford Avenue.
 HORNIMAN, F. J., M.P., Surrey Mansion, Eastern Terrace.
 HARDCastle, S. B., 71, East Street.
 HILTON, THOMAS, 16, Kensington Place.
 HAINES, W. H., 24, Hampton Place.
 HICKLEY, G., 92, Springfield Road.
- INFIELD, H. J., 130, North Street.
~~ISAAC, T. W. PLAYFAIR, 114, Marine Parade.~~
- JENNINGS, A. O., LL.B., 50, Brunswick Place, Hove.
 JENNER, J. H. A., Eastgate House, Lewes.
 JOHNSTON, J., 12, Bond Street.
- KILMISTER, CHARLES, F.R.H.S., 56, Buckingham Road.
 KNIGHT, JOHN J., 33, Duke Street.

LOMAX, BENJAMIN, F.L.S., C.E., Public Library.
LANGTON, HERBERT, M.R.C.S., 11, Marlborough Place.
LODER, GERALD W. E., M.P., Abinger House, Brighton, and 48,
 Cadogan Square, London.
Lewis, J., 37, Preston Road.
LAW, J., The Wallands, Lewes.
LEWIS, J., C.E., F.S.A., 54, Cromwell Road, Hove.
LAMSBACK, L. P., 66, Grand Parade.
LOCKYER, G., Midland Bank Chambers, North Street.

MERRIFIELD, F., 24, Vernon Terrace.
MITCHELL, W. W., 66, Preston Road.
McKELLAR, EDWARD, M.D., J.P., Woodleigh, Preston.
MORGAN, G., L.R.C.P., M.R.C.S., 45, Old Steine.
MARTIN, C., 45, Montpelier Road.
MAGUIRE, E. C., 41, Grand Parade.
MUSTON, S. H., 54, Western Road.
MAY, F. J. C., 25, Compton Avenue.

NEWSHOLME, A., M.D., M.R.C.P., 11, Gloucester Place.
NORMAN, S. H., Burgess Hill, Sussex.
NORRIS, E. L., 3, Cambridge Road, Hove.
NEWMARCH, Major-General, 6, Norfolk Terrace.
NICHOLSON, W. E., F.E.S., Lewes.
NICHOLSON, Mrs., 9, Park Crescent.

PANKHURST, E. A., 3, Clifton Road.
PUTTICK, W., Brackenfell, Hassocks.
PETITFOURT, E. J., B.A., F.C.P., 8, Sudeley Street.
PARIS, GEORGE DE, 5, Denmark Terrace.
PRINCE, H., 146, North Street.
PEARS, H. KILBY, JUNR., 16, Western Road, Hove.
PAYNE, W. H., 6, Springfield Road.
PENNEY, S. R., Larkbarrow, Dyke Road Drive.
PERRY, AYLETT W., Annesly Hall, Dyke Road.
PRANKERD, DR., 6, Evelyn Terrace.
PAYNE, E., Cuckfield.

RUTTER, J., M.D., M.R.C.S., 142, Western Road.
ROSS, DOUGLAS M., M.B., M.R.C.S., 9, Pavilion Parade.
ROSE, T., Clarence Hotel, North Street.
ROBERTS, J. P. SLINGSBY, 3, Powis Villas.
RODGERS, J. C., 7, Leune Strasse, Coblenz.

- READ, S., 12, Old Steine.
 RICHARDSON, F. R., 15, Clifton Terrace.
 ROBINSON, M. E., Saddlescombe.
 RYLE, DR., 15, German Place.
- SASSEON, SIR E. A., BAET., 1, Eastern Terrace.
 SMITH, T., 85, Church Road, Hove.
 SMITH, W., 6, Powis Grove.
 SAVAGE, W. W., 109, St. James's Street.
 STEPHENS, W. J., L.R.C.P., 9, Old Steine.
 SALMON, E. F., 30, Western Road, Hove.
 SLOMAN, F., 18, Montpelier Road.
 STONE, HAROLD, L.D.S., M.R.C.S., L.R.C.P., 18, Regency Square.
- THOMAS, J., 28, Old Steine.
 TRAUTLER, W. J., M.D., 8, Goldstone Villas, Hove.
 TANNER, J. SLINGSBY, 104B, Mount Street, Berkeley Square,
 London.
 TALBOT, HUGO, 82, Buckingham Road.
- UHTHORP, J. C., M.D., F.R.C.S., M.R.C.P, Wavertree House,
 Furze Hill.
 UPTON, ALFRED, L.R.C.P., M.R.C.S., Rio Lodge, 55, Western
 Road, Hove.
- VERBALL, HENRY, 26, Gloucester Place.
- WILLETT, HENRY, F.G.S., Arnold House, Montpelier Terrace.
 WINTER, J. N., M.R.C.S., 28, Montpelier Road.
 WOOD, J., 21, Old Steine.
 WILLIAMS, H. M., LL.B., 17, Middle Street.
 WALLIS, W. C., 15, Market Street.
 WILKINSON, T., 170, North Street.
 WOOD, FREDERICK, 12, Lewes Crescent, Kemp Town.
 WALTER, JOHN, 13A, Dyke Road.
 WHITTLE, E. G., M.D., F.R.C.S., 9, Regency Square.
 WELLS, ISAAC, 4, North Street.
 WOODRUFF, G. B., 24, Second Avenue, Hove.
 WHYTOCK, E., 36, Western Road.
 WARING, F. J. A., M.D., 8, Eaton Road, Hove.
 WEBLING, A. H., Trinity House, Hampstead Road, Preston Park.
 WIGHTMAN, G. J., Wallands Park, Lewes.
 WEDD, H., 22, Albert Road.

WESTON, S. J., 24, Church Road, Hove.
WILLIAMS, A. STANLEY, 17, Middle Street.
WRIGHT, A., 25, Park Crescent.

ASSOCIATE.

THOMS, H. S., Museum, Church Street.

LADY MEMBERS.

BINTON, MRS. HANNAH, 40, King's Road.
BAGLEY, Miss, Heidelberg House, 38, Medina Villas, Hove.

CAUSH, MRS., 63, Grand Parade.
CAMERON, Miss E., 25, Victoria Street.

GRAHAM, Miss, 42, Tisbury Road, Hove.

HARE, Miss, 17, St. Michael's Place.
HERMING, Miss, Heidelberg House, 38, Medina Villas, Hove.

JONES, Miss MARY, 6, Selborne Road, Hove.

LAWRENCE, Miss P., 36, Sussex Square.

NICHOLSON, MRS., 9, Park Crescent.

RICH, Miss, 34, Sussex Square.

SKEVINGTON, Miss, 41, Buckingham Place.
SALMON, Mrs., The Grange, Preston Park.

TREUTLER, MRS., 8, Goldstone Villas, Hove.

WOOD, MRS. J , 21, Old Steine.
WILKINSON, MRS., 30, Brunswick Place, Hove.
WEBB, Miss A. H., 54, Tisbury Road, Hove.

HONORARY MEMBERS.

ARNOLD, Rev. F. H., The Hermitage, Emsworth.
BLOOMFIELD, Rev. E. N., Guestling Rectory, Hastings.
CURRIS, T., 244, High Holborn, London.
DAWSON, C., F.G.S., Uckfield.
FARR, E. H., Uckfield.
JENNER, J. H. A., East Street, Lewes.
MITTEN, W., Hurstpierpoint, Sussex.
NOURSE, W. E. C., Bouverie House, Mt. Radford, Exeter.
PHILLIPS, BARCLAY, 7, Harpur Place, Bedford.
PRINCE, C. L., The Observatory, Crowborough, Sussex.



BRIGHTON AND HOVE
**Natural History & Philosophical
Society.**

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

Year ending June 14th, 1899.

Brighton:

J. G. BISHOP, PRINTER, "HERALD" OFFICE.

1899.

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BRIGHTON AND HOVE
Natural History & Philosophical
Society.

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

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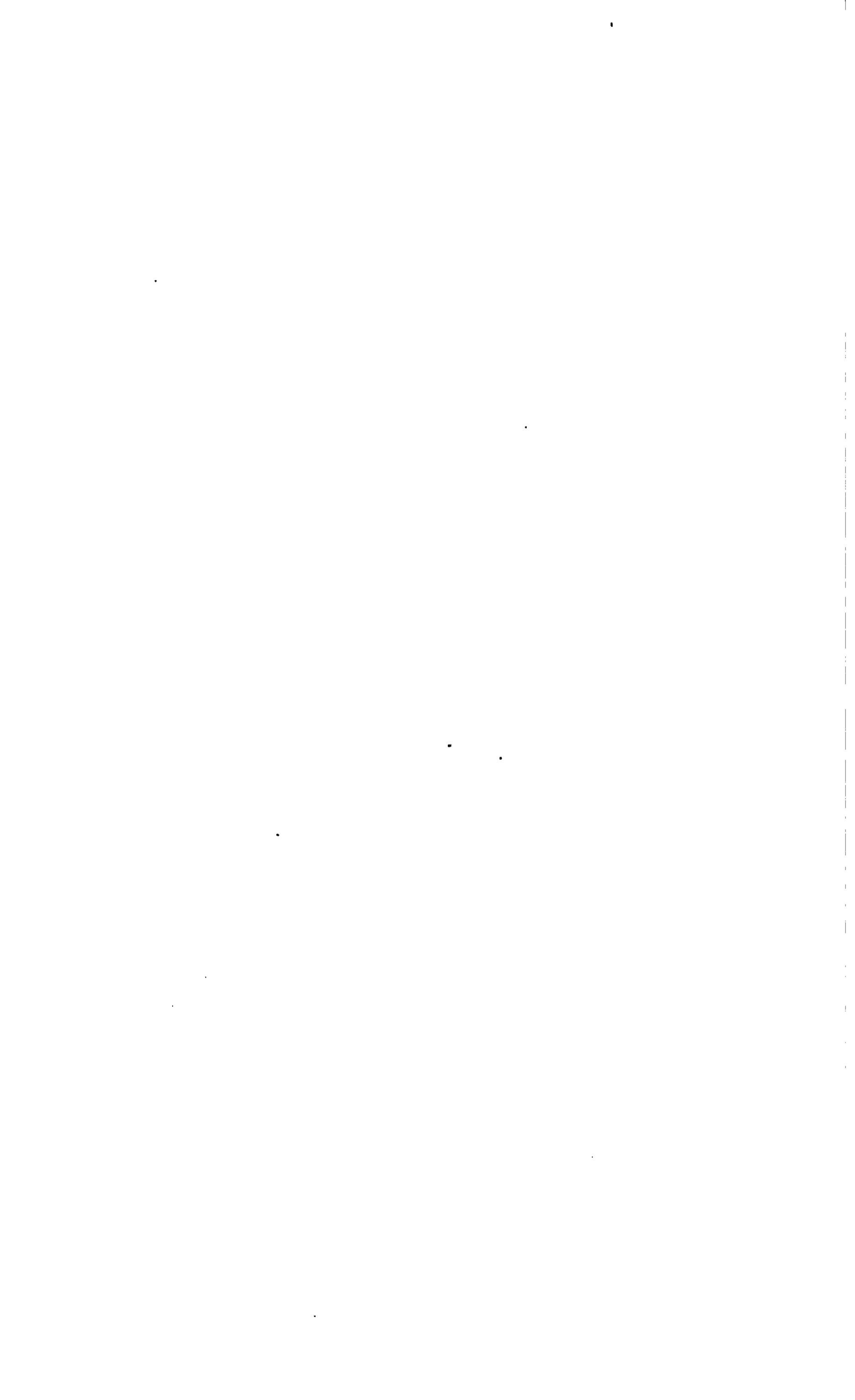
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SESSION 1898-1899.

WEDNESDAY, OCTOBER 12TH, 1898.

INAUGURAL ADDRESS

BY

DR. W. J. TREUTLER, F.L.S.

(PRESIDENT), ON

"Music in its Relation to Man and Animals."

DR. TREUTLER began by pointing out that one of the charms of the study of Nature is that as soon as we look beneath the surface, what strikes the superficial observer as common-place, becomes at once a source of fascinating interest and admiring wonder. "This is eminently the case," he remarked, "with the phenomena connected with the occurrence and production of sound in animated Nature from man down to the humblest insect. Nature is full of living sounds of a more or less musical character. . . These all have their meaning, and the Naturalist asks, What is their origin and source, their cause and their motive?" Even if it were possible, the answering of these queries would, the Doctor said, occupy more time than was at his disposal then, and all he could do was to offer some thoughts and suggestions. He defined "music" broadly, for the present purpose, as "a succession of sounds so combined and modulated as to please not only *our* ear but *some* ear"—the object of music being the gratification of the sense of hearing. "In the Mammalia, including man, and in birds, sounds are produced by an organ specially adapted for the purpose—the larynx, an open tube across which are stretched certain structures termed the vocal cords. These are governed by certain muscles, and can be thrown into vibrations more or

less rapid by an expelled current of air. But in insects, sound is produced by a very different arrangement, namely, by the friction of certain string-like structures in the wings or in some cases on the legs, against certain plates or membranes, which are often stretched across a cavity situated on the side of the body, the whole resembling in general character and principle our various stringed instruments. Besides these more common sources of sound, the wings are often variously used by birds for the production of different kinds of sound, and in these the feathers are often curiously modified to serve a like purpose.

Now, we know that nearly all the characters, proceedings, and properties of animals have reference to the struggle for existence, and are useful to them either in procuring food or as a means of defence, and that it is a distinct advantage to them to acquire or bring to perfection certain characters or organs ; and the vocal organs or other means of producing sound certainly are of use to them in this respect, and so come within the operation of the law of natural selection. This applies to the cries and call notes of most animals, which serve, as I have already said, as a means of communication or of recognition between communities and individuals or as warnings against danger. But the case appears different in regard to their more strictly musical performances. And here a remarkable fact appears to furnish a clue to the question of the use and purpose of animal music, whether vocal or instrumental. We find, namely, that in most animals, especially birds and insects, the possession of musical powers is limited to the male, and further that these powers are actively exercised by the male exclusively during the season of courtship and mating. This would indicate that the employment of music by animals is, often at all events, of a sexual character, and serves to charm and attract the female, and numerous observations show that this is so. And very often animals, notably birds, combine for this purpose music with remarkable gestures and antics and regular dances ; as witness the performances of various species of gallinaceous birds,—the capercailzie, blackcock, grouse, jungle fowl, and others. I have seen in India, in an open spot in the midst of a dense jungle, a single peahen surrounded by a circle of 15 to 20 admiring peacocks, in full and magnificent plumage, with their glorious tails erect and displayed to the fullest extent. These kept up a chorus of loud and energetic screams, all the while dancing and leaping around the lady, who, though apparently wholly indifferent to these attentions and calmly pecking about in the grass for worms, was no doubt perfectly conscious all the while of being the object and centre of so much homage. In their case the end and issue of their performance were lost, for, becoming conscious by

some means of being observed and watched, the whole party, hen and all, precipitately took to flight and disappeared.

Other music than that with which the love-lorn creature tries to give expression to its feelings then came under consideration. Monkeys, said Dr. Treutler, might literally be said to sing, for they utter musical sounds in ascending and descending scales, with intervals of almost exact semi-tones. Several other animals sing in true cadences of definite notes, notably the white-banded mocking bird. Of him it was said, "This bird will begin his performance by reproducing for the first half-hour with marvellous fidelity the more or less melodious songs of a score of species, and then, as if to show off by contrast his own greatly superior powers, he will pour forth his own divine song with a power and wild abandon in a continuous torrent of joyous notes of surprising brilliance and variety. Hudson likens the song of this bird to a melody sweetly played in tune, the notes never coming in the same order again and again, but with endless variations, like the most artistic improvisation, the song being accompanied all the while with the most graceful and appropriate and harmonious movements. These outpourings, Dr. Treutler demonstrated, were certainly not the "song of yearning or unsatisfied love." It was rather an expression of joy and gladness. He would go so far as to say that music existed in all animals as a part of their nature, and was employed by them to express emotion or feelings under various forms of excitement.

Discussing the question of music amongst man, Dr. Treutler said, "Whereas the vocal and musical powers of animals, birds, and insects are practically the same now, at the present day, as they were thousands of years ago, the music of man has advanced from crude and rudimentary forms and has developed into an Art. The note of the cuckoo, the song of the nightingale, or of the La Plata mocking bird are the same now that they were ages ago and long before man appeared upon the scene." Granting even that sexual selection may have influenced and determined the development of music in its early stages, it was wholly insufficient to account for the vast progress and high degree of refinement of modern music. A capacity for music might exist without any high development of the musical art. It would appear (he said) that the sense of music is and has been inherent in human nature from the earliest times; that musical faculties and talents may be latent in races and dormant in individuals requiring but a suitable combination of circumstances for their development and adequate training and exercise to bring them to perfection. A noteworthy instance of this is furnished by the Jews, who have within the last 100 years developed to a remarkable degree their musical capacity with which they appear to have been endowed from very early times, but

which had laid dormant in them for more than 18 centuries. If was their emancipation which afforded them the opportunity of unfolding and developing their sense and talent for music, and enabled them to excel in every department of the musical art, and to furnish us with performers and creators of music, such as Mendelssohn, Meyerbeer, Rubinstein, Joachim, and many others. Music was an invention. The experiences and attainments of one generation of men were handed down by tradition to the next generation, and so progress was made, but animals, learning nothing from the experience of ancestors, made no progress. Music with birds was but speech. Regarding the improvements in music, Dr. Treutler said the instrument within ourselves, which is at once the seat and source of musical perception and susceptibilities, our soul, is and has been inherent in man through all time, and has advanced but little, if at all ; but being exercised and trained from early life by better methods and on higher work, it yields proportionately higher and better results. The history of all advance and improvement in the art of music proves this. We have only to think of the reception which Beethoven's choral and other symphonies, and Wagner's operas, met with at the hands of audiences and performers on their first appearance, and compare it with the estimation in which these great works are held now by the public. The musical sense of those days, though by no means of a mean order, was yet unable to grasp and understand the meaning of these great tone poems ; it required the training and education of years to enable our musical faculties to intelligently appreciate these creations of genius.

The Lecturer inclined to the theory of Professor Weissman, that the faculty of music must be regarded as in a manner an outgrowth, a bye-product, of the sense of hearing. Weissman argues that we may regard the musical, and, indeed, every artistic faculty, as the spiritual hand which plays on that part of our inner nature which we call the soul. For our faculty of music consists of two parts,—the organ of hearing and the auditory centre of the brain. The former, the ear, receives the waves of sound, converts them into nerve vibrations, and transmits them to a certain part of the brain,—the auditory centre,—which converts these nerve vibrations into tone perceptions, which are arranged and analysed and combined by the intellect, and so ultimately form that mysterious and potent subtle thing we call music. In animals not only were the sense of hearing and the cerebral auditory centre considerably developed and organised, but they were also able to some extent to intellectually comprehend and interpret music itself.

After instancing the effect of music on certain animals, notably the way war-horses understood bugle calls, Dr. Treutler

went on :—Now, from all this it is evident that for the full and thorough understanding and intelligent comprehension of the higher forms music as we have it at the present day, there is necessary something more than the external organ of hearing and the cerebral auditory centre, however highly these may be developed and exercised in the individual. And this “something more” is a sensitive, feeling, impressible, and highly-organised *soul*; we must have on the one hand the material ear of the body, and on the other hand the spiritual ear of the mind, and the influence exercised by the former, the material organ, on the latter, the spiritual and immaterial organ, and the effects produced, and the nature and degree of the response elicited, must vary according as the soul is more or less highly developed. It is the soul, that mysterious but very real component of man's nature, which is acted on, in a manner played upon as an instrument by the material perception of sound; and the more perfect the instrument the greater will be the effect produced. So that the intelligent comprehension of music even by the higher animals will always be more or less imperfect, because their soul is of a lower order, their intelligence is unable to grasp and comprehend the sequences and rich combinations of musical sounds. And hence the effect of music on animals cannot be other than fragmentary and imperfect; it can at least be only in the most general and superficial way, agreeable or otherwise, but there cannot be any approach to a comprehension of the deep and subtle meanings of music, of major or minor keys, or of musical form.

This musical soul of man is capable of progress and development by education, cultivation, and training, and has been so developed from one generation to another, and from the days of primitive man. Doubtless this process of development of the musical art, like that of all other Arts, dated back to a very early age; but unlike the sister Arts of painting, poetry, sculpture, and the like, the musical Art has progressed by slow and unequal stages. The ancient Greeks have left us abundant evidence of the height attained by them in these sister Arts; but what do we know of their music?

Thus we see that music, in its elementary stages, is but a congeries of vague sounds and indefinite noises “without form and void,” to which we can hardly apply the term “music”; but it has ever been the manner and means by which most living beings express their state of mind; while music as an Art becomes more than an imitation of external things, as is the case more or less with the other Arts, but it is the expression of the inmost being of man and of his profoundest feeling and emotions. Thus the study of the evolution of music from the rudimentary stage of expressive noises and cries is one of

extreme interest, with the gradual acquisition and invention by degrees of melody and rhythm, scales and harmony, until it reaches its full development in the choral and instrumental music of modern times. Though it has reached so high a state of development, yet we cannot, may not, suppose that no further progress is possible, and in truth its capabilities of progress are only limited by the like capabilities of the human soul and intellect of the human race itself. At first a mere toy and plaything, it has by long continued serious effort, and earnest, reverent cultivation, risen to the dignity of the highest form of Art, exercising the most humanising influence on man, and embodying his noblest sentiments and aspirations.

Petroleum in Sussex.

PAPER READ BY

MR. C. DAWSON, F.G.S., F.S.A., &c.,

AT AN

EXCURSION OF THE SOCIETY TO HEATHFIELD,

JUNE 11TH, 1899.

THE discovery, which has been recently announced, of petroleum in East Sussex resolves itself into the fact that gas or vapour such as emanates from petroleum has been found to exist in the underlying strata in that part of England. Some little time back the Brighton Railway Company sought to obtain an enlarged supply of water for the service of their locomotives on the Tunbridge Wells and Eastbourne line. For this purpose a boring was commenced at the Heathfield Railway Station, which, in reality, is situated in the parish of Waldron, whereby the latter name is sometimes applied to this particular undertaking. As the work proceeded, and the bore-hole went deeper into the earth, there was an unmistakeable odour such as might proceed from oil of an inflammable nature. At length a light was applied to the mouth of the pipe leading up from the bore-hole,

**PETROLEUM IN SUSSEX :
Gas from the Boring at Heathfield Station.**

(By kind permission of *Black and White*.)

and at once a brilliant flame rose up to an altitude of about fifteen feet, the diameter of the pipe being nearly six inches. The flame was extinguished with some difficulty, and as it was found afterwards that more gas continued to flow, the attempt to find water was abandoned, a depth of three hundred and seventy-seven feet having been reached. The pipes which lined the bore-hole were withdrawn, except that a short length was left at the top, to which a cap was affixed, so as to limit the flow of gas, if not arresting it altogether. But the gas continued to assert itself, escaping at every joint which remains, although blocked at the summit. The pipe projects up from the bottom of a shallow well or shaft, and it is in that part the leakage takes place. On a light being applied by the Station Master, Mr. Head, who descended the shaft for the purpose, ignition ensued round the circumference of the pipe where the joint existed. Evidently it only needed the removal of the cap in order for the huge jet, fifteen feet high, once more to show itself.

To this point reference will be made presently, but for the present it will be interesting to notice a circumstance not hitherto recorded. About three years ago a boring was made in search of water in the stable-yard of the Heathfield Hotel, also in the parish of Waldron, the site being some seventy feet higher than the top level of the Station boring, and about a hundred yards distant. At a depth of two hundred and twenty-eight feet an oily odour was observed, and gas became evident. As there happened to be water in the tube, the gas, as it rose, caused an ebullition which might be described as boiling without heat. The foreman in charge of the works piped off the gas to a distance of several feet, and there consumed it, the flame rising to what was called "the height of a man." The boring was then carried down about twenty feet further, but as gas continued to come instead of water, the undertaking was abandoned, and the fiery pit was sealed up with concrete. The incident serves to show that the discovery at the Heathfield Station was not the mere result of a lucky hit, but was caused by the presence of a gas which also existed at a higher level and at a distance of a hundred yards. But the area is far wider than this, gas having manifested itself several miles off, in the Sub-Wealden boring at Netherfield.

The gas from the boring at the Heathfield Station has been examined by Mr. Woodhead, the Public Analyst of East Sussex, who pronounces it to belong to the paraffin series. This at once connects it with petroleum. But where is the petroleum which throws off the gas? Mr. Dawson considered the balance of probability to be in favour of the conclusion that the gas is derived from the Kimmeridge clay which underlies the Purbeck beds. This view he entertains, although the

latter beds contain dark leathery shales, which emit a strong odour of petroleum. But the Kimmeridge clays are specially characterised by indications of the oil, and their shales have been worked during past years in Dorsetshire, where petroleum has been obtained from them by distillation. The most interesting part of the problem is whether free petroleum may be met with at a lower depth. The experience in America is that the gas is first encountered, and the oil comes later on. The gas seeks to rise, and in so doing impregnates the rocks which lie above it. Let a free vent be given, and the gas rushes to the surface, as we see at Heathfield. The pressure exerted by the gas is shown by the obstacles it overcomes. At Heathfield the removal of the lining tubes from the boring has caused portions of earth to fall in from the sides and partially block the channel. There is also water in the boring, creating a considerable downward pressure. Still the gas ascends, and shows a good amount of force at the surface, while leaking at every joint. The lighting power of the gas is described as equal to twelve and-a-half candles on the usual scale. Burnt on the incandescent principle, in a mantle, it produces an admirable light. But, as pointed out by Mr. Woodhead, this is obviously due to its heating power, which is considerable. It is described as free from impurities, and has but little odour. The Analyst states that it smells like petroleum.

It is said that the quantity of gas escaping from the single bore at Heathfield would yield a sufficient supply for lighting a small town, and it has been suggested that it might be "piped off" to illuminate Hailsham, Eastbourne, or Tunbridge Wells. Supposing this to be too sanguine a view of what might be done with the present supply, it seems a matter for regret that the gas should either be wasted or absolutely bottled up in the depths of the earth. More important still is the consideration whether the existing flow indicates the existence of a large and valuable store, to be discovered by further search. The gas has given tokens of its presence over a rather wide area, and it may possibly be found at greater distances. The depth also has to be borne in mind, and by seeking to find the actual starting-point of the gas we may attain to what would be termed the fountain-head of the gaseous stream. It may be asked—If the gas is good for anything, why do not the Brighton Company lay it on for the purpose of lighting up the Heathfield Station? It is remarkable that the discovery at the Heathfield Hotel was so completely disregarded. "Natural gas" appears to be at a discount in the neighbourhood. In the public interest, and their own, it would now seem to devolve on the Railway Company to take the matter up, and have it thoroughly investigated.

It has been mentioned that the Heathfield Railway Station

is in the parish of Waldron. The well-known geologist, Gideon Mantell, who disposed of his geological collection to the British Museum for five thousand pounds, and afterwards received a pension from the Crown, has recorded in his work on the Geology of Sussex, published in 1822, that at Newick Old Park, Waldron, "seams of fibrous coal, resembling that of Bovey," had been discovered, but the thickness and extent of the beds had not been correctly ascertained. Another account states that at Waldron a thin bed of "cannel coal" had been noticed on the banks of a rivulet which separates that parish

the "Philosophical Transactions of the Royal Society." In the volume for 1684, is a paper by Dr. Robert Plot, in which he expresses the belief that the perpetual lamps said to be found alight in ancient tombs might be formed of a wick of "linum asbestinum," or "salamander wool,"—the material which we now call asbestos,—fed by a natural spring of naphtha such as that of Pitchford, in Shropshire, where, he says, "is a naphtha or liquid bitumen which constantly issues forth with a spring there, and floats on the water." This spring, which is still in existence, at one time (at the beginning of the century) had considerable celebrity, as the oil was distilled and sold as Betton'

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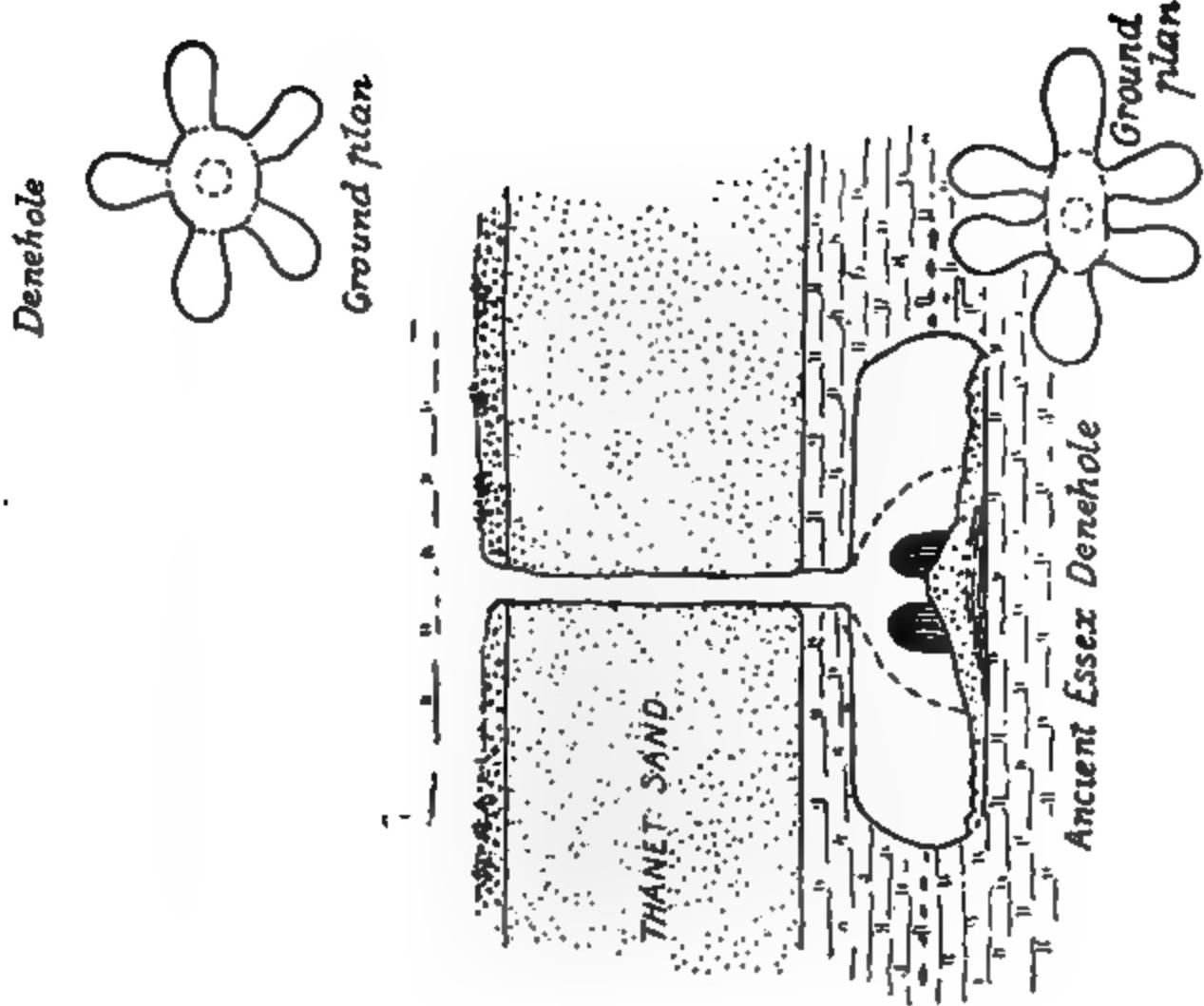
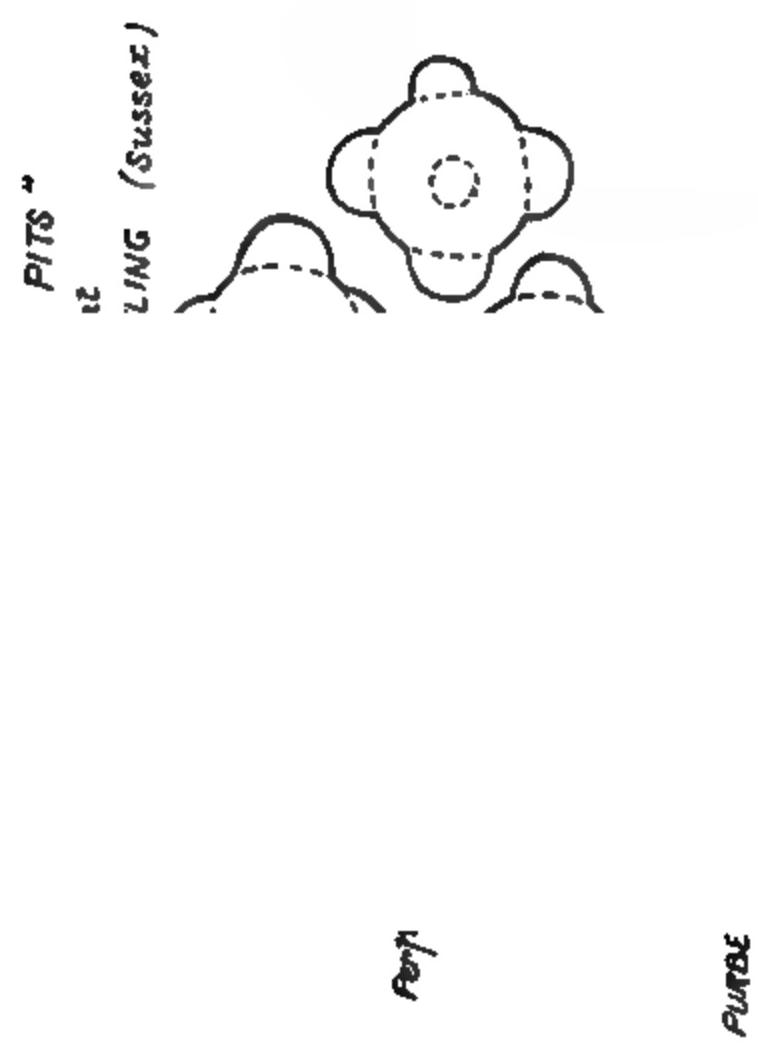
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The existence of petroleum has been detected in this country at different times, especially in the West of England. Considerable interest was excited in 1894 by a discovery of this kind at Ashwick Court, in Somersetshire. If of no commercial importance, the matter is still one of the greatest historical interest, as the shale oil industry is the direct outcome of the distillation of a small outflow of petroleum at Alfreton, in Derbyshire, and the American petroleum industry itself, as will be shown later on, may be indirectly traced to the same source. Numerous references to the occurrence of "naphtha" or "liquid bitumen," and even to emanations of natural gas, occur in the early numbers of the "Philosophical Transactions of the Royal Society." In the volume for 1684, is a paper by Dr. Robert Plot, in which he expresses the belief that the perpetual lamps said to be found alight in ancient tombs might be formed of a wick of "linum asbestinum," or "salamander wool,"—the material which we now call asbestos,—fed by a natural spring of naphtha such as that of Pitchford, in Shropshire, where, he says, "is a naphtha or liquid bitumen which constantly issues forth with a spring there, and floats on the water." This spring, which is still in existence, at one time (at the beginning of the century) had considerable celebrity, as the oil was distilled and sold as Betton's

British oil, as a cure for sprains and rheumatism ; indeed, it is one of the very earliest localities where petroleum was distilled for commercial purposes.

Similar occurrences were noticed at Broseley, Bently, and other districts in Shropshire, and Camden's " Britannia " (1586-1607) described oil and gas springs at Fife, and at Formby and " Wiggin," in Lancashire, and the " boyling " of eggs by the burning gas, although the water through which the gas issued remained cold. Petroleum was found quite two hundred years ago at St. Catherine's Well in Liberton, and is still found at Longton, in Staffordshire, Coalbrookdale and Wellington, in Shropshire, at Worsley and West Leigh, in Lancashire, and in the neighbourhood of Bristol. In the Southgate Colliery, near Chesterfield, there is an intermittent flow of petroleum, amounting to from seventy to one hundred gallons daily. The most interesting occurrence of petroleum in this country is, however, one at Alfreton, in Derbyshire, where a small stream of oil flowing from a coal-working attracted the attention of Dr., now Lord, Playfair, and was, in 1847, distilled on a commercial scale by Dr. James Young, the father of the shale oil industry of Scotland. When this supply became exhausted, as soon happened, Dr. Young, believing that the oil had been produced naturally by the action of gentle heat on coal, commenced the experiments which resulted in 1850 in his celebrated patent for obtaining paraffin and paraffin oil from bituminous coal, and ultimately to the extension of this process to the bituminous shales of Scotland. Erroneous as were Dr. Young's premisses, the whole of the Scottish shale oil industry is the direct result of them, and the commencement of the American petroleum industry may also be traced to them. Shortly after the inception of the Scottish industry, a large number of establishments, working under royalties from Young's Company, were in existence in the United States, and by 1859 there were between fifty and sixty in existence. In that year, in the hope of obtaining larger quantities of the crude petroleum which was found superficially in many districts in Pennsylvania, and was then still believed to be a product of the natural distillation of coal, the celebrated " Drake " well was sunk at Tarentum, in Alleghany, and started the oil fever, of which the present position of the American petroleum industry is the outcome. The production of these immense quantities of oil without the cost of winning and distilling shale or coal, naturally struck the death-knell of the shale distilleries of the States, which, with the ready adaptability of the American people, were, however, at once converted into petroleum refineries, but the Scotch shale oil industry, although severely handicapped, has, so far, been able to eke out a precarious existence.





REMARKS
ON
**The Visit to the Bell Pits (or Dene
Holes) at Brightling, Sussex,**
BY
MR. C. DAWSON, F.G.S., F.S.A.

THE method of bell-pit mining, as practised at Brightling, Sussex, is one of the earliest forms of mining in the world. It is mentioned by Pliny as existing in Britain at the commencement of the Christian era. At Brightling the system is exemplified by the sinking of narrow shafts (three to four feet in diameter) to a distance varying from twenty to sixty feet; the object being to obtain the limestone known as the Purbeck "Greys" and "Blues" for road metal. The peculiarity of these pits is that, after having dug out a bell-shaped cavity at the bottom of the shaft of *such diameter as the pit-man considers safe*, and the limestone has been extracted, the whole excavation and shaft is abandoned, and a fresh one commenced within a few feet away; but care is taken that the new excavation shall be disconnected from the old one. The science of mining by timbered and propped sides is imperfectly understood. This system of mining was largely adopted at one time throughout England, and nearly always in chalk districts, where the chalk lay a small distance from the surface, and where it was required for manure. Even where the chalk crops out upon the surface, within a mile away, it was found cheaper, in the last century, to dig the chalk for use as manure in this manner rather than cart it, because carting necessitated the maintenance of a team of horses, vehicles, and labour, disproportionate to the amount of business carried on by many farmers. The chalk manuring was carried out from bell-pits, sixty loads per acre, for the sum of thirty-five shillings, all expenses included. In more ancient times the expense and labour would have rendered a system of carting altogether beyond the means of the richest farmer, except where water carriage was possible. In some counties the old

system of bell-pit mining for chalk is still in use, but in others, such as Essex and Kent, it is altogether forgotten. In those counties where the practice is still carried out or remembered these excavations are known as "chalk wells" or bell-pits; in other counties where the system has been abandoned and forgotten, they are not unfrequently called "Dane holes," for the simple reason, as many archaeologists have observed, that the English peasantry are in the habit of attributing any mysterious excavations and ruins to the agency of the Danes, and especially anything relating to calamity. Thus the "Dene" or "Dane holes" are locally pointed out as being old hiding places and receptacles for storage of crops in time of danger, for which they are obviously most unsuitable. It is marvellous that in one county the system should be carried forward in all its old efficiency, while in others the results of the self-same system should be involved in a romantic haze, arising from ignorance of the original use of these excavations. It is curious that although the excavated chalk had been removed and laid on the neighbouring field for manure, that the very absence of chalk should have been attributed to the desire of the persons who were supposed to have inhabited these dwellings to conceal the site of the entrances of the shafts. So deeply imbued were the supporters of these theories that it seemed in vain to reiterate that there is no evidence of any habitation, and that the absence of chalk débris is the best evidence of their having been used for chalk-pits according to a past and present custom. The concentration of a few groups of pits in Essex is by no means unusual; in fact, all ancient writers agree that large tracts of ground were honey-combed for the purpose, and so dangerous was their vicinity that woods grew up and flourished around them. Respecting the alleged beauty of design and finish of the Essex and Kent "Dene holes," it may at once be stated that such allegations are made up of gross exaggeration and misconception. Such of the flints at the sides of the walls of the excavation, which were pointed out to visitors as being carefully trimmed so no sharp points should injure people, are nothing more than bands of tabloid flints which have a naturally straight fracture, and break off with a slight blow flush with the excavated surface. The design of these pits are necessarily uniform and pillared both for safety as well as to prevent the encroachment of one pit upon another. Every mining engineer knows that, without some such regularity and system in design, waste and danger must accrue.

Nothing further need now be said. Mr. C. Roach Smith long ago animadverted on the fallacy of considering these excavations anything more than chalk pits *where other evidence does not exist* (and, so far, no evidence is forthcoming). It was left to the

author to produce crushing evidence from the writings of agricultural experts of the last century in support of Mr. Roach Smith's view (*vide* "Transactions of the South-East Union of Scientific Societies," 1898, and Mr. W. T. Vincent (President), *Proceedings Woolrich District Antiquarian Society*, 1898, with which Mr. T. V. Holmes's paper in the *Geological Magazine*, October, 1898, may be compared).

The writer's paper was accompanied by accurate diagrams, as a comparison with the original excavations has shown. The chalk workings, described by Mr. F. J. Bennett, appended to the Essex Denehold Report (Essex Field Club), must not be taken as being at all typical of the general form of "Bell-pits" or "Dene holes." The truth is that variation in form, depth, and size, apart from general design, has little to do with the question, and arise from the differences of soil, custom of working, and the age of these excavations.

THURSDAY, NOVEMBER 10TH, 1898.

Protection in Nature.

BY

COLONEL C. SWINHOE, M.A., F.L.S.

COLONEL SWINHOE explained his object as being the giving of a few notes collected from various authors and from personal investigations, rather than the reading of a strictly scientific paper. In so doing he aimed at getting people to make observations on a subject in which many further investigations are necessary and in which those who take it up will find a never-failing interest.

His interpretation of the phrase "protection in Nature" was the protection brought about in the course of ages through natural selection for the benefit and preservation of living creatures, and his intention was to show examples of protective resemblance, aggressive resemblance, and mimicry.

"Any observer of Nature," he said, "must often be struck with the fact of the extraordinary resemblance many animals bear to their surroundings. Wherever we go we find the insects

in the green grass and in the green leaves of a green colour, and those living in the sand of the colour of the sand, and so on throughout all orders of creation.- By protective resemblance we mean the resemblance to their surroundings, which enables animals to pass unobserved by their enemies and so escape destruction. The cases of the hare, lemming, stoat, and many other animals in northern latitudes are excellent illustrations; these become white every winter and brown every summer. It is obvious that a brown hare in a snow-field would be a very conspicuous animal, and that the palest members of the species would be those that would escape destruction; and the next year the palest of the survivors; and so on from year to year and age to age until in time all would naturally become white as the snow through natural selection or the survival of the fittest. And the same reasoning as to white hares in brown heather will apply, until natural selection has brought it about that all these animals become white in winter and deeper coloured in summer. A very curious theory, and apparently a very accurate one, has lately been expounded by an American artist, Mr. Abbot H. Thayer, as to the reasons for the white breast and abdomen of so many birds and mammals; he says it is undoubtedly a protective quality. He has presented to the British Museum and to the Museums of Oxford and Cambridge models of a bird in duplicate, one coloured all brown, and the other brown above with white breast and abdomen. The former is dark and distinctive and a prominent object at a distance; the latter is ghost-like, not very distinct when quite close, and rapidly fades out of sight as you move away from it; the white beneath neutralises the shadow of the creature and thus makes it invisible, and makes it a beautiful example of protective resemblance, whereas the brown belly intensifies the dark colour."

Pictures of several species of a low order of life, notably insects and crabs, in which the resemblance of the animal to its surrounding conditions acted as a protection to it, were thrown on the screen. Then followed slides illustrative of the Lecturer's argument as to aggressive resemblance, where the colour of the creature, harmonising well with its surroundings, enabled it the more easily to come at its prey. Colonel Swinhoe was careful to point out that in many cases the similarity was doubtless both protective and aggressive. The second set of pictures included representations of the walking turtle and of certain fish.

As regarded Mimicry in Nature two theories were put forward. One, propounded by an entomologist named Bates in 1862, suggested that creatures specially appetising as food to their neighbours are protected by their resemblance to creatures of a noxious order in whose company they live. This extraordinary theory was advanced by Bates, who was a close observer,

as the numerous personal observations, more especially in the valley of the Amazon.

On all fours with it was the theory of Fritz Müller, also arrived at from much personal observation. This supposed that a common type of appearance among distasteful insects in the same locality acts as a common advertisement to enemies, so that the loss of life which must ensue during the time in which each generation of enemies is being educated to avoid the owners of a particular type of pattern and colouring, is shared between these species, instead of being borne by each of them independently ; it is, in fact, a multiplication of protection. As might be expected, all, or nearly all, animals protected by their distastefulness, are brightly coloured and mostly of distinctive patterns. Professor Lloyd Morgan's and Mr. Finn's recent experiments, made independently in different parts of the world, prove that there is no inherited knowledge of suitability or unsuitability for food, but that everything of an appropriate size and at the right distance is pecked at and tasted by young birds ; on the other hand, young birds are extremely quick in learning, and have very retentive memories. Furthermore, one unpleasant experience makes them suspicious of other things, and they remember well the appearance of the insect which gave them a disagreeable surprise.

What was true of birds was probably, said the Colonel, true of other animals as well.

As an illustration of Müller's theory, he exhibited a few groups of "distasteful butterflies," which were mimicked in appearance by others which might otherwise prove too appetising to live.

Moreover, from the various examples it appeared that females were more frequently defended than males, a fact rendered more desirable for them on account of their slower flight when laden with eggs, and of other disabilities of their sex.

In conclusion, Colonel Swinhoe pointed out that the theory of mimicry and of common warning colours was believed by scientists, not because we have demonstrative proof in a complete knowledge of the details of the struggle for existence,—it will be very long before we attain to this,—but for the same reasons that we believe in evolution, because the theory offers an intelligible explanation of a vast number of facts which are unexplained by any other theory as yet brought forward, and especially because it enables us to predict the existence of facts which can afterwards verify.

WEDNESDAY, NOVEMBER 28TH, 1898.

Telegraphy, with and without Wires,

BY

DR. J. A. FLEMING, F.R.S., &c.

BEFORE proceeding to the more sensational division of his subject, the Professor began by a little exposition of the method of telegraphing with wires, "and," he wisely observed, "I shall not venture to assume that those whom I address are experts in this matter." Next year, in the little town of Como, where he was born, will be celebrated the centenary of the discovery of the electric current by Volta, the wizard who dwelt at Pavia. A photograph of the present statue of Volta at Como was thrown upon the sheet, and due honour was done to the great names of Ampère, Joseph Henry, and Sturgeon. In shadow pantomime, through the medium of a powerful lantern, the phenomena of electro-magnetism were exhibited,—the phenomena upon which the whole apparatus used in the most elaborate telegraphy is founded. It is to Ersted that the credit belongs of finding out the fact which enabled these phenomena to be utilised. He it was who first noticed that the direction of a magnetic needle enclosed in an electric circuit is reversed by the reversal of the direction of the current. With the possibility of transmitting to a distance by means of the electric current these opposite indications of the needle, Dr. Fleming explained that the foundation of telegraphic communication was laid, because whenever you have two signs which are able to be repeated in varying alternation, you have the possibility of making a code. The whole operation of sending a telegraphic message in its elementary form was here shadowed on the screen. No one person, said the Doctor, could claim to have been the inventor of the telegraph, but it was first put into practical form in England by Wheatstone and Cook, who invented the "five-needle telegraph," i.e., an instrument wherein the cumbrous code which had at first to be employed was simplified by the use as indicators of five separately controlled magnetic needles.

Then were dealt with the later elaborations of the "wire,"—the discovery of the fact that if a wire along which a current was to run were carried downward to the earth, the earth itself

would complete the circuit ; the wonderful Morse printing telegraph ; and the culminating improvement of the Hughes type-writing instrument, which flashes the message to its far destination at the moment the operator touches the magic keys. Before passing on to the marvels of "wireless" telegraphy, the Lecturer stayed to say a few words about submarine cables,—"the nervous system of the world," as he called them. The difficulty with long-distance cables was at first a commercial one. They cost a lot of money, and business men wanted to know at what rate they would deliver the messages sent over them. At long distances the effect of the current was very much lessened, and the problem of how to receive the messages was for some time a difficult one. Then, with admirable clearness, the Lecturer explained, by means of a diagram, Lord Kelvin's beautifully ingenious invention of the refracting galvanometer, in which the almost imperceptible oscillations of a tiny needle of watch-spring steel, enclosed in a circuit at the receiving end, are magnified and made readable to the operator by means of a strong ray of light thrown upon and again reflected from it. As a fitting climax to the description of telegraphy with wires, the facsimile of an Atlantic cable message as written by another of Lord Kelvin's machines was thrown on the sheet. "Upon the whole, it isn't worse than some persons' handwriting," commented the Lecturer on the weird lines that zigzagged across the paper.

The second part of the subject was opened by an eulogy of Faraday, "the father of modern electricity," who, in the early part of the century, used to go day by day to his laboratory, with the regularity of a business man to his office, to wrest from Nature the secrets of her magic. He it was who found out the secret of the induction coil, and that if a copper disc be revolved between the poles of a magnet a current of electricity is set up without any other aid,—a discovery which Dr. Fleming called the "great-grandfather of all modern dynamo machines." In 1865,—an important year in the history of electricity,—Clarke-Maxwell, a pupil of Faraday's, came first to the definite conclusion that electrical effects must be due to operations taking place in a medium filling all space, and that these operations consisted of wave-like movements in this medium, "ether," which were of a different order from those which are appreciated by our senses as light. A very beautiful illustration to explain the purely up-and-down vertical motion of the substance of waves was thrown on the sheet. It was now practically proved, said Dr. Fleming, that the medium whose existence we had to assume to explain the phenomena of light, and that which we assumed to explain electricity, was one and the same.

When an electrical spark was made in the air, the electrical effect was propagated in all directions,—it was practically making a splash in the ether, as a stone makes a splash in water, and sends out concentric circles radiating from the splash. The connection of this fact with the amazing phenomena of "wireless" telegraphy is, as he very clearly explained, immediate and all-important. One of the principal facts which the clever young Italian, Marconi, was the outcome of the researches of the German doctor Herz. It was found that if an electric circuit, part of which was enclosed in a glass tube, were interrupted in a special manner by a small space within the tube, the current would over-leap that space, and continue its action, while if this space were occupied by fine metal filings, the current was stopped. If, however, the ether waves from an electric spark fell upon this tube, the filings would become arranged, and, in some mysterious way that is not yet understood, the current would be re-established. Here was the secret of wireless telegraphy. For if this "coherer," as the tube with the filings was called, was connected with a bell battery so that when the current was established the bell would ring, and vice-versa, a method of signalling was at once established. By making electric sparks of long or short duration send their waves upon the coherer, long or short rings would be produced, which could be interpreted, as a sound alphabet, by the Morse code. In practice it was found that unless the battery creating the sparks were close to the coherer, a couple of long metal rods attached to the ends of the latter were absolutely essential, their effect being to seize a greater length of the electric wave, in a way comparable to that in which an ear trumpet gathers a greater length of sound waves for a deaf person. It was this discovery of the effect of the rods in rendering the receipt of signals possible at a distance that was Marconi's peculiar contribution to "wireless" telegraphy. Dr. Fleming had got a coherer and rods, and a battery upon the platform. He made a spark at one end, and the bell attached to the coherer instantly rang from no visible cause in the wierdest way. A smaller coherer was carried by the Lecturer's assistant all round the room, and the bell was rung by the waves sent out from sparks of the battery on the platform. It would make no difference, said Dr. Fleming, if they carried the coherer out into the Pavilion grounds, for "stone walls do not a prison make" for the ether waves. By means of high masts, with wires running from a cross piece at the top to the earth Signor Marconi had succeeded in sending a telegraphic message 84 miles through empty air. It was not really "wireless" telegraphy, for these wires on the masts were necessary, and the longer the perpendicular length of wire, the further could the

message be transmitted. A question that naturally arose was : how can such messages as these be differentiated, if you have a number of receiving stations ? To this question, Dr. Fleming said, no satisfactory solution had yet been discovered. At the present stage, if everybody set up " wireless " telegraphy, all the messages would get sadly mixed up. It was a serious limitation, but with the few stations so far set up the difficulties had not arisen. Having thrown on the sheet a facsimile of a message received by himself through the air in this way, printed by attaching to the receiver the ordinary machine, he concluded by the remark that the most remarkable aspect of the subject was the proof given that space is not empty. Of all the inventions that had crowned the reign of Queen Victoria none was more remarkable than this of " wireless " telegraphy.

WEDNESDAY, DECEMBER 7TH, 1898.

Light-Holding Appliances from the Earliest Times,

BY

MR. EDWARD LOVETT.

THE LECTURER, having given much attention to this subject for many years, was enabled to illustrate his remarks by photographs taken from the large number of specimens in his possession. These he had collected from all parts of the world, and it was interesting to compare the forms of oil lamps from the Hebrides, the native tribes of the Himalayas, and from the interior of China. Although all served the same purpose and embodied the same principle for the supply of oil, &c., to the wick, it was interesting to observe how much the forms varied according to the locality, and what ingenious devices were adopted by different people to obtain the same result.

It is impossible to do justice to Mr. Lovett's interesting lecture without the illustrations which made it so attractive. Regarding the ancient rush-holder, of which some specimens that he showed were made of Sussex iron, Mr. Lovett explained the reason why it was called the " poor man."

Before this holder was invented labourers used to be hired to stand in farmhouses at night to hold the torch that gave light, thus making living candlesticks of themselves. When the holders were devised the name of the " poor-man " clung to them.

WEDNESDAY, JANUARY 11TH, 1899.

**Microscopical Demonstration
(METHODS OF CUTTING AND MOUNTING),**

BY

MR. D. E. CAUSH, L.D.S.

THURSDAY, FEBRUARY 16TH, 1899.

Spiders : their Work and their Wisdom,

BY

DR. DALLINGER, F.R.S., &c.

DR. DALLINGER commenced by admitting the prejudice against spiders, observing that the poor creature, rather than being an object for careful and sympathetic observation, generally inspired no feelings but those of loathing and disgust. These feelings were inculcated from the days of the nursery ; the strong crushed the spider, the weak and the timid fled from it, and to the ignorant it was an object for repugnance and contempt. The cause of all this was to be summed up in two words, "Inherited prejudice." The prejudice was in no sense justified by facts. After this introduction, Dr. Dallinger went into the subject quite from the point of view of the scientific observer. Of the abundant folk-lore and superstitions that have grown around the spider, he mentioned only the Greek story of Arachne, the daughter of a Lydian dyer, and so skilful in spinning that she challenged the goddess Athene to a trial in the art. Arachne's work was so beautiful that the goddess, like any ordinary mortal, was filled with jealousy, and tore the embroidery to pieces. Poor Arachne hanged herself, and the goddess, smitten

with compunction, changed the rope into a thread and the maiden into a spider. And that was why spiders were, pre-eminently, the spinners.

With respect to the derivation of the name, Dr. Dallinger said that spider and spinster meant much the same thing, etymologically. Built expressly for the purpose of spinning, the spider was the most specialised creature known. He called her a creature because she was not an insect. An insect went through the larva and chrysalis stages, whereas a spider was always a spider. There were two groups of spiders, sedentary and wandering, the sedentary catching their prey by means of snares made with wonderful ingenuity, while the wandering variety, though beautiful weavers, did not make snares, and literally had no place of abode. Of the sedentary spiders, some wove their webs in a circular shape, some in lines, some in tubes, and some in tunnels. The wandering spiders were divided into those who walked sideways, like a crab, and those who leaped on their prey. By means of magic lantern slides, the majority so beautiful that they evoked spontaneous bursts of applause, the Lecturer gave illustrations of these various types. Particular interest centred in the tunnel spider, over which the Lecturer waxed quite enthusiastic. This creature dug a tunnel into the ground from six inches to two feet deep, and lined the sides with silk with perfect regularity. For a lid it wielded together some forty layers of silk and clay, and hinged it over the top of this funnel. When closed, the presence of the aperture could not be seen, so perfectly did the lid fit. To further secure the lid, the spider drilled holes in the sides, and, when attacked, drove its claws into these holes to act like bolts.

"Do these spiders think," asked the Lecturer? One might almost fancy they did; and, to emphasise the point, he told of a spider which, when leaping a chasm, or performing some other dangerous feat, fastens a thread to her starting point so that she might have a rope to hang by, and climb up again should she miss her footing.

With the aid of diagrams, Dr. Dallinger proceeded to explain, in the clearest way, the internal structure of the spider, and the process by which she spun her silk, a structure so marvellous in its elaborateness and perfection of details, as to put to the blush even the intricate machinery used in modern manufactures. It was a section of the lecture that might easily have become very dull, but, in Dr. Dallinger's hands, it was one of absorbing interest.

Even more fascinating was the detailed description of how a spider builds its web and the ingenuity and engineering knowledge it displays in overcoming difficulties. He described how, in bridging over an intervening space, it waits until a current of

air comes that will blow a thread in the direction required. As soon as the thread reaches its destination the spider pulls it tight,—“ though,” added Dr. Dallinger, “ how it knows I cannot tell, for it is always looking the other way.” Then it waits until the thread has hardened, and then proceeds to build a triangle underneath it. In this triangle it puts up its many sided web, connecting every angle with the centre, and filling up all spaces with closely set lines, moistened with gum. A peculiar fact mentioned by the Lecturer was that the spider understood the theory that in a vibrating cord there were nodes, certain points always at rest. It twanged its lines as soon as it covered them with gum, and the gum collected itself on each node in the form of spheres. So what man looked upon as a recent discovery the little spider had known for thousands of years. A feature of this section of the lecture was the way it was illustrated by slides representing the working spider in motion.

The relation of these facts brought Dr. Dallinger again to the question of whether the spider could think, and, to illustrate his belief that they must have something akin to reasoning power, he gave an instance that had come under his own notice. A spider by the sea found a gully where the wind always blew steadily one way, and it erected its web there. It was just as if it argued that, with such a decided current of air, it was likely that a goodly harvest of flies would be brought down. At the same time, it realised that such a strong current of air would speedily wreck the web, so it took pains to make the fundamental parts of the structure specially strong. It put in additional buttresses, and even ran skeins on the windward side from the web to the ground, strengthening the fabric in the particular way necessary with the skill of an engineer. How did the spider know that all these extra precautions were essential? Surely it argued a way out of the difficulty.

A striking way was chosen by the Lecturer to demonstrate the extreme thinness of a line in a spider's web. It was no good talking about the fraction of an inch, so he threw a picture of a line on the screen. Over that he threw a ruling of lines, drawn on the same scale, each a thousandth part of an inch apart. The difference between the spider's hair and a thousandth of an inch was as the difference between a thread of fine silk and a stout hawser!

Some people probably wondered what the spider lived for; was all this output of ingenuity simply for the degrading object of catching flies? He could not answer that question. But it must be remembered that all animals lived by preying upon others. Even the refined ladies and gentlemen before him suffered no qualm of conscience when eating a fowl or rabbit.

Oh! of course, it was very different. Perhaps so; the spider ate its food raw and we cooked it first. He was convinced that the spider pre-eminently ate to spin; many men spun to eat. There was no penetrating the mysteries of Nature; whether we searched the starry spheres with a telescope, or examined the spider with the microscope, we found the same omnipotent wisdom, the same infinity.

WEDNESDAY, FEBRUARY 22ND, 1899.

Pain,

BY

MR. G. MORGAN, F.R.C.S. ED., L.R.C.P.

TAKING up the consideration of a central nervous system consisting of brain and spinal cord, and of a sensory surface of skin, Mr. Morgan set himself to explain the connection between these two by means of the nerves, which are "practically the electric cables and the finer electric wires of the nervous system, conducting impulses to and from the tissues and organs on the one hand, and the nervous centres on the other." The "first essential" of a nervous fibre is "its axis cylinder or Axon, which is a cylindrical, or band-like, pale, transparent structure, which, after being treated by certain re-agents, shows itself composed of very fine homogenous or more or less beaded *fibrillæ*." This cylinder is enveloped in "its own hyaline sheath, the Axilemma." The next essential of the nerve fibre is an insulating material, surrounding the Axon as gutta-percha surrounds the copper of an electric wire. This insulator, which is "bright, fatty, and glistening," is called the medullary sheath, or white substance of Schwann." Outside the white substance of Schwann is the "Neurilemma," which forms the outer boundary of the nerve fibre.

Each nerve has its own blood vessels ramifying outside and within its sheath, giving off smaller vessels that supply the ultimate fibres. And it is through these small vessels that certain neuralgic pains are caused when the blood is loaded with the toxins of "malaria, or influenza, or other specific disease," or has been robbed to a certain extent of its oxygen.

earning properties. The blood is then brought into direct contact with the small fibres, and the result is—pain.

When the various electric cables, or nerves of the body, reach the spinal cord, they divide into two parts. Those which give the power of movement pass to the front of the cord, while those which convey sensation enter the back part of the cord. Sensory impulses, or "feelings," from the right side of the body pass up the left side of the cord, and those from the left of the body pass up the right.

The rate at which "painful impressions" may travel from the skin along the nerves of feeling to the brain is estimated to be about the same as the rate at which the power of action passes down the "motor" nerves when communicated from the brain to the muscles. The actual speed at any given time is believed to vary according to temperature, and other circumstances which cannot be easily defined. It may sink as low as 30 miles per second if the limb concerned is cold, or if the limb is heated it may rise as high as 89 miles per second.

Not a few have tried their hand at defining pain, and explaining the reason of its existence. Pathologists, theologians, and philosophers have all spoken, and have found some kind of an audience to listen to them. The pathologist says, "Pain is the sign of diminished functional activity,"—which is prosaic. The theologian says, "Pain is the penalty of some broken law." There is truth in the statement, but it is not the whole truth, and nothing but the truth. The philosopher, "who has some poetry in his make-up," says "Pain is the prayer of the nerves for blood." Another definition, which Mr. Morgan thought would recommend itself as "simple and suggestive," and as emphasising the truth that pain is not an unmixed evil, is, "Pain is the protector of the voiceless tissues." Pain is not in many cases simply revenge for broken law, but its first object is remedial. Of this the Lecturer gave a number of examples. Among other things he said that chilliness, which is a species of "painful impression," makes people walk faster, or draw near a fire, and so ward off a cold or something worse; or it may cause a sneeze, which is Nature's attempt at arousing the nerve centres.

But pain frequently passes beyond this beneficent stage as a warning voice, and becomes a positive danger by its presence. If it is really acute and continuous the general health suffers. Indeed, it may be so acute as to cause fatal collapse, especially if the heart is not sound. The organs of the body are capable of becoming the seat of pain with different facility. No doubt those nerves specially regarded as nerves of sensation are generally those which conduct pain, but true sensations of pain can be conducted through the nerves of special sense, such as sight, hearing, &c., by increasing their specific energy.

In particular it happens in the case of the eye and of the ear, that intense light and loud and grating sounds produce sensations which we speak of as paining the eye and ear. Pain, therefore, has no specific quality.

With the feeling of pain there may be mingled a localised impression by which we are to some extent capable of deducing the cause and nature of the pain. We can tell a burn from a pin-prick, or a cut from pressure, and by the same apparatus we can characterise the various pains that occur in disease as "burning," "tearing," "stabbing," &c.

Persons who are half ashamed of their cowardice in bearing pain may take heart of grace. For "there is not the least doubt that some are far more sensitive to pain than others." Their nerves are more easily impressed, and pain is more quickly produced in them than in others. As a rule females suffer more than males. There is a state known to the learned as *hyperesthesia*, in which certain nerves, such as those of taste or smell, are rendered extraordinarily sensitive. One can see illustrations of *hyperesthesia* even in North-street, when the brake of a descending omnibus is unusually active, and one can observe the marked difference in the effect which the noise has upon different occupants. The children as a rule enjoy it as a pleasant diversion, some of the occupants may be unaffected, while others will be tortured almost beyond endurance.

Dentists, too, notice the marked difference in patients as to the amount of pain they suffer. Mr. Morgan thought it is sometimes wrongly expressed when we say that some "bear" pain better than others. It may be a fact that they do, but it is equally a fact that some do not feel the pain as acutely as others.

The fact that the disease or injury is not always at the same spot as the pain may be surprising. There is frequently such a thing as "reflected" or "sympathetic" pain. A familiar example is to be found in the case of a blow to the "funny" bone, otherwise the "internal condyle of the humerus." When the bone is struck the tingling sensation is not felt at the seat of the injury, but is "reflected" to the terminal distribution of the nerve in the little finger. The same sensation is felt if the outside of the leg a little below the knee be knocked, when the tingling will be "reflected" to the toes. (These facts may be experimentally verified if desired.)

A number of other cases of "reflected" pain were adduced, and Mr. Morgan said that just as pain could be induced by reflex action, so it could be subdued. One other very curious fact alluded to was that of *pseudesthesia*, or false pain. A clergyman the Lecturer knew had his leg amputated after a severe injury, and had a cork leg. He had had bad corns on his original leg, and naturally thought he had felt the last of them. Not so.

As the reverend gentleman stumped to Church he was constantly in pain as if from the corns on his vanished leg, and for years afterwards, as he lay in his bed with his cork leg on a table hard by, he would start with a sudden twinge of pain, as if from his corns. This was by no means a singular case, though a severe one. A little girl who had had an amputation at the forearm said, "My fingers hurt me, nurse, especially the little finger." The explanation of this singular phenomenon lies in the fact that each fibre of sensory nerve comes from a certain part of skin, bone, or tissue, and is the special conductor for that part and no other. After an amputation the continuations of the nerve fibres from the amputated limb are still present, and if irritated send an impulse to the brain, which is registered as if coming from the original part. But this false pain does not continue indefinitely. The nerve fibres coming from the amputated member eventually atrophy, though how soon or how late it is impossible to say. The seat of pain, physical and mental, is the brain, and any part having no longer any connection with that organ is no longer subject to pain.

Whether or no physical pain is more or less common than it was fifty years ago it would be difficult to say. Mr. Morgan was inclined to take the more hopeful view. But he felt there could be no doubt that mind pain, or *phrenalgia*, is a far more serious enemy to-day than it was years ago. "It is to-day what biliousness was half a century ago, and is due, like the old biliousness, to reckless living, though in a different form. The hurry and bustle of life, the high speed and pressure, the severe competition which too often demands that the whole of a man's energies shall be sacrificed at the altar of business or professional life, crowded out digestion, sleep, and all such trifles. And then what? At fifty or sixty a man has money, but no capacity for enjoying it wisely. And then, when the stimulus that came from an over-busy life is suddenly taken away, the brain atrophies from want of stimulus, and the poor man becomes a prey to *phrenalgia*.

MONDAY, MARCH 18TH.

The Skin of Liquids,

BY

C. H. DRAPER, B.A., D.Sc. (LOND.),

Municipal School of Science and Technology.

AS is the case with most of the deeper facts of physical science, in dealing with the "skin of liquids" we are dealing with something which is itself invisible. You cannot skin a mass of water as you can a hare, and hold up the skin *in omnium conspectu*. But its existence may be proved by means of a delicate little instrument devised by a physicist named Mensbrugghe. Take a piece of cork, affix a ring of thin wire to one end, and a weight to the other. Adjust the weight so that the apparatus floats upright in water with the ring just above the surface. Then take a small rod, and gently push the whole device down under the water. Experience ought lead one to suppose that on taking away the rod, the float would return to its first position. If, however, the float be carefully balanced so that the wire ring, on being allowed to rise gradually, touches the surface all round at the same time, the apparatus will rise no higher,—showing that the film of water at the surface offers more resistance to the passage of a solid body than either the water below or the air above.

A second experiment brings home the existence of the "skin" in a more striking way. "Here we have a sieve with very small meshes," said Dr. Draper, "and if water be poured carefully into it, the water does not run through, because the skin formed between the meshes blocks up the small holes. You remember the people who, in the days of our childhood, when nothing was impossible, went to sea in a sieve? Well, I should not mind going to sea now in a sieve, if I were allowed to make the sieve, and have full command of the weather. Here is a small sieve made of copper, which is nine times as heavy as water, yet this sieve might be warranted to carry a small burden on smooth water. It is, in fact, a boat floating with 10,000 holes in the bottom—the more holes the better for the boat."

The next thing he showed was a bowl containing wires, darning needles, and such-like articles, composed of metal seven or eight times as heavy as water, all floating about as happy as could be. Nevertheless, it is easier in some respects to launch a torpedo-destroyer than a darning needle. The best method is to grease it slightly, take it tenderly on the prongs of a fork—the needle, not the torpedo-destroyer—and lower it gently, keeping it perfectly horizontal.

After a reference to the familiar spectacle of water-flies skimming the surface of a pool, Dr. Draper came to another illustration of his subject. If a sheet of muslin be carefully stretched over a ring held horizontally and water be gently placed upon it, by means of a pipette or syringe, a large flattened drop may be obtained on the muslin without any of the water passing through. The surface film touches the muslin, which is not really wetted by the water. And so long as the skin remains unbroken the water does not pass through, and the muslin remains dry. If once the skin be broken the threads of muslin become wet and the drop or part of it passes to the under surface of the muslin, and if the drop there formed be too heavy it falls off, and so a stream is started which will carry nearly all the water away. In this case the water does not, however, all escape; there is a skin above the muslin and another forms below, and a quantity of water is held imprisoned between them. People who live in tents in rainy weather often have decided experience of these matters. When a steady rain falls on canvas it does not at first make its way through. A film spreads all over the material, and so long as this skin remains unbroken all the interstices between the material are filled up and no wet gets through. But the slightest touch at any spot brings the film through to the inside, and then the water will run through as though a hole were cut in the canvas. The use of umbrellas is based on the same principle, and their effectiveness is limited in the same way.

Though all liquids have films of this kind, yet all the films are not of the same strength. Ether, for instance, and alcohol, are much more "thin-skinned." If Mensbrugghe's float be submerged as already described in water, and ether or alcohol be allowed to become mixed with the water, the float immediately breaks its way through. The surface tension of water is greater than that of any other liquid except mercury.

Dr. Draper then described a number of experiments devised to show other properties possessed by the "skin" besides that of resistance to penetration. The most characteristic of these is its contractility, which may be observed in many different ways. A good method is to suspend one lucifer match horizontally from another by means of a thread at each end,

the threads being of such a length that the two matches form the upper and lower lines of a square perpendicular plane. If this be dipped into some soapy water it will come out bringing a film of water with it, covering it like the skin of a drum. But instead of the threads hanging vertically as they did before immersion, they are curved inwards, and the bottom match is raised up, showing that the surface film is exercising a pull and endeavouring to contract. If the film be broken the lower bar falls. The whole film consists of two skins with a layer of water between them. The film is thus seen to behave like a piece of stretched indiarubber, which is always trying to contract, but it differs from stretched indiarubber in one respect. With the stretched rubber the tendency to contract is different according to how much it is stretched, while with a liquid film the tendency to contract is always the same at the same temperature, however much or little it may be stretched. Such films as the above are plane surfaces, but liquid films may be also cylindrical or spherical. A cylindrical film is easily obtained by placing two wet wire rings in contact with each other, and lifting the top one. If the bottom ring were not too heavy, the contractile force of the cylindrical film would lift it up. The power of this contractile force may be vividly manifested in another manner. If two plates of glass six inches square have a film of water between them in this way 1-200th in. thick, they are pulled together with a force about equal to the weight of six pounds. Spherical films are seen in the case of falling drops of liquid, partially spherical films in the case of drops resting on a solid surface, where they are acted on by their surface tension, tending to make them perfect spheres, and the force of gravity tending to flatten them out.

An interesting explanation was that which Dr. Draper gave of the effect of throwing a suitable kind of oil upon water to calm it. Water being so much "thicker-skinned" than oil, the latter, when cast upon it, immediately spreads out over the water until the layer of oil gets so thin that it ceases to behave like liquid oil at all. To this fact must be added that already alluded to in the float experiment, that any other liquid mixed with water lowers the resistance which the "skin" of the water offers to breaking. Suppose, then, a ship to be surrounded by a layer of oil. The waves come rolling along towards it, reach the distant edge of the oil film, there suddenly experience a lessening of the tension of the surface, and break there accordingly. The main swell of the wave rolls on, but the ship is in the middle of a ring of breakers, which surround it at the outer boundaries of the film of oil.

"On to a flat plate," said Dr. Draper, "we pour a thin layer of coloured water, about 1-10th or 1-8th inch thick. On

this water we place a little alcohol. Immediately the water rushes away and stands round in a circular ridge like a hollow crater ! It leaves the middle almost, if not entirely, bare of liquid, save that some of the alcohol at least will not take part in the flight. The tension of the pure alcohol is 25, while that of pure water is 81. Hence the surface film is set in motion from the alcohol towards the water all round, and motion ensues of so energetic a character as to leave a bare place where the drop of alcohol was put. A dimple may be formed on the surface of water by holding a brush or small sponge dipped in ether or alcohol just above the water surface. This retreat of water from the presence of alcohol, which I am treating as a physical fact with no moral significance, may be observed in an ordinary tumbler. If in the middle of the surface of a glass of water a small quantity of alcohol be gently introduced a rapid rush of the surface occurs outwards from the place where the spirit is introduced. If the sides of the glass be wet with water above the level of the surface, and the spirit be introduced in sufficient quantity, the fluid may be seen to ascend the sides of the glass, accumulate in certain places, and fall down again into the mass of the liquid. Wine contains alcohol and water, and when it is exposed to air the alcohol evaporates faster than the water. In a deep vessel like a wine glass, this produces little effect at first in the mass of the wine, but a good deal in the thin layer of wine which, if the glass be disturbed, exists on the sides of the glass above the liquid surface ; tension being greater in the most watery parts, it pulls itself literally together away from the alcoholic parts where the tension is less. These ridges flow down the sides by their own weight. As they slide down they may sometimes be seen to stop and retreat when they come into contact with the alcohol. So the process goes on until in time there is very little alcohol left in the wine glass."

The surface tension of liquids is lowered as their temperature rises, until, at their boiling point, it is reduced to *nil*, and they are reduced to vapour. If 100 drops of water be collected from the hot-water tap, and 100 drops from the cold, it will be found that the amount of water obtained from the cold tap exceeds the amount from the hot tap, the reason being that the hot films break more quickly, not being able to support such large drops.

A little practical application of the laws of surface tension is useful in getting rid of drops of oil from clothing. If a ring of turpentine, ether, or benzol, whose surface tension is very low, be made round the grease spot, the grease immediately retreats on to its centre, where it may be absorbed by blotting paper. Or the grease spot may be "chased about" by threatening it with a

hot poker. If the hot poker be applied to one side of the cloth, and blotting paper be applied to the other, the grease, in its hurry to get away from the poker, is driven into the paper.

The curious phenomenon of "capillary attraction" was also dealt with by the lecturer as one of the effects of surface tension. When the ends of fine tubes are immersed in liquid, the contractile force of the surface film pulls the water up the tubes, he said, to a height inversely proportional to the diameter of the tube. Soap bubbles, ripples on a liquid surface, the effect of electricity on the "skins" of liquids, and finally the minute thickness of these "skins" were among the other matters which Dr. Draper spoke about. It appeared that the thickness of the subject of his paper was no greater than between 1—100,000th and one millionth part of an inch. "Somewhere about here," he concluded, "we reach the limits of physical divisibility, and also of my remarks."

WEDNESDAY, APRIL 26TH, 1899.

Röntgen Rays as an Aid to Scientific Investigation,

BY

MR. E. PAYNE, M.A.

MR. PAYNE first gave a short description of the discovery of the X-rays by Professor Röntgen at Würzburg in November, 1895, reminding the audience that the subject had already been treated at a previous meeting of the Society soon after the discovery.

He pointed out that there were two methods of using the rays in scientific investigations: 1, by the aid of the phenomenon of fluorescence; 2, by the use of the photographic plate.

Different substances become fluorescent when the X-rays fall upon them, one of the best for practical use being platinocyanide of barium, fine crystals of which were spread upon a

sheet of vellum, mounted on a frame, so as to form a "fluorescent screen."

Substances placed between this screen and a focus tube emitting X-rays cast shadows, the density of which would depend upon the thickness of the object and upon its permeability to the rays. When permanent results were required a photographic plate was used. This was placed in a light-tight bag or holder, made of paper or other substance permeable to the rays, which then acted on the sensitized film after passing through the paper, &c. The plate thus gave a permanent record of the shadows which might be seen on a fluorescent screen, the effect on the plate depending upon the permeability of the different parts of the object placed between the plate and the tube.

The permeability of a substance to X-rays differed from its transparency to ordinary light. Glass, for instance, was somewhat opaque to the X-rays; while diamonds were transparent or permeable. The metals were on the whole opaque, aluminium being the most transparent. Vegetable substances were transparent to the rays. A metal object, placed in a wooden box, would, therefore, give a shadow on the screen. Bone, owing to the lime salts contained in it, was more opaque or less permeable than flesh; for this reason it was possible to obtain shadows of the bones of men and animals through the flesh and skin. This fact had led to the use of the rays for medical and surgical purposes, and constituted the most important application of the rays, as it enabled us to make investigations in the living body which had never been possible before. Each substance had, therefore, its particular or specific permeability to the X-rays, as it had a specific resistance to a current of electricity, or a specific gravity or conductivity for heat. And the fact that this permeability was different for different substances enabled us to make use of the rays for scientific investigations; we could study the internal structure of a body, or measure and localize hidden objects.

The Lecturer then showed a number of lantern slides to illustrate the applications already described. These consisted mostly of photographs of X-ray pictures of shells and animals and other radiographs taken for surgical purposes. A picture of a large shell of the nautilus type showed the internal structure with the successive divisions built by the animal as it grew. Another picture, of a rat, showed all the bones in every detail. The gradual growth of the bones was illustrated by a slide showing three elbows taken from children of different ages with one of an adult for comparison. This illustrated the use of the rays for the study of the growth of the bones in men and animals. The way in which bones are broken was illustrated by a slide showing three radiographs of fractures of the femur, taken at the Children's Hospital. A large number of prints from plates

were exhibited illustrating the use of the rays for showing diseases of the bones, such as necrosis, periostitis, and tuberculosis, also hip disease. There were also some radiographs of the lungs, showing cavities and thickening in the lung tissues.

The Lecturer then explained the methods of measurement and localization. This is done by taking two or more radiographs from different points of view, and noting accurately the position of the tube with regard to the body containing the hidden object. By constructing a figure with lines showing the path of the rays, the size and position of the hidden objects can be readily shown. These methods are used for the localization of needles, shots, &c., in the hands and feet, and, where necessary, for stones in the kidneys.

Some stereoscopic pictures were shown at the conclusion of the lecture, by the aid of some Wheatstone stereoscopes. These included radiographs of a rat, and of a mole, giving the appearance of a solid body of transparent material, through which the structure of the skeleton could be distinctly seen. Similar effects were given by radiographs of some shells. As illustrating the possible application of the rays for botanical investigation, radiographs of some nuts were exhibited, showing some with unsound kernels, some without any, or with only imperfectly developed kernels.

WEDNESDAY, MAY 10TH, 1899.

Before and After Newton,

BY

MR. HENRY DAVEY, JUN.

AT the outset Mr. Davey made allusion to Darwin's theory of evolution as compared with Newton's theory of gravitation, but without discussing the respective importance of the two theories, or the priority in genius of the two philosophers, turned to the contemplation of the prodigious change effected in thought by the labours of Sir Isaac Newton, "who at the age of 45 published the greatest of all scientific works, and then lived 40 years longer without producing anything of special importance."

Newton himself was a man of absolutely unsurpassed genius for Science, though several points in his life are at least questionable. He was engaged in a good many serious quarrels ; and from his early life constantly made discoveries which he did not publish to the world. De Morgan justly said that first Newton made a discovery, and next the world had to discover that Newton had discovered it ; and the latter part of the process was the longer and more difficult. Most fortunately Newton had a friend in Halley, who with singular tact recognised and fulfilled the task of preventing Newton's genius from being wasted, at least, till the publication of his *magnum opus*. The stupendous results which Newton achieved were owing to his possession of a mind equally adapted for induction and deduction, and to his faculty of *guessing* correct results and then spending years of patient toil in irrefragably proving his guesses. Buckle says that only Aristotle and Newton have shown themselves able to reason with absolute accuracy both inductively and deductively ; and elsewhere, that no poet, except Dante and Shakespeare, possessed so soaring and audacious an imagination as Sir Isaac Newton.

Newton was born on Christmas Day, 1642. His youth and early manhood were passed in his native Lincolnshire and at Cambridge University. What was the state of Science then ? It was a very great period, politically, for then occurred the Civil War, the execution of the King, the establishment of a Commonwealth, the military rule of a Huntingdonshire squire, and, finally, the Restoration of the Monarchy and the Episcopalian Church. All this upheaving and unsettling of ancient convictions and habits had produced a general ferment in Englishmen's minds, and the greater part of the nation had finally become zealous for nothing in politics and religion, and were ready to turn to any other interesting pursuit. Already during Newton's infancy a number of men were in the habit of meeting to discuss scientific questions in London, and during the Commonwealth at Oxford. After the Restoration they were incorporated and chartered under the name of the Royal Society.

Mr. Davey passed on to point out that it was Lord Bacon who was the first "to make Science respectable." That a Lord Chancellor should write an elaborate work in the grandest style, recommending the cultivation of Science, was a complete novelty ; and though the writer was by no means abreast of the Science of his own day, and had little effect in his lifetime, yet a generation afterwards his philosophy was of the deepest influence, and made Science not only respectable, but even, for some time, a fashionable pursuit, which even Charles II. and his courtiers delighted in practising. It was now felt that unknown possibilities lay hid in the world of Nature, and everyone expected results rather too rapidly. There were still here and

there a few old-fashioned men unleavened by the Baconian spirit ; and one Shropshire clergyman wrote a tract to denounce the Royal Society's making experiments in new directions, instead of studying the wise ancients. Nor were there wanting those who supposed the study of natural history to be irreligious ; but the adhesion of several Bishops and the direct patronage of the King soon destroyed this belief. What was objected to was not the study of natural history in itself, but the original researches made, and the avowed intentions of discovering novelties. The objectors were, however, few, and soon heard of no more, and the romantic dream of Bacon, embodied in his " New Atlantis," was, in effect, realised. There was in England a Solomon's House, with Merchants of Light, Depredators, Lamps, and Pioneers, endeavouring to discover the secrets of Nature, and make them of practical advantage. Also they understood their task much better than Bacon did. What seems so obvious to us was a romantic dream in Bacon's days, and to his contemporaries it must have seemed childishly trivial ; the maintenance of scientific experimenters and discoverers would to them have been not only a dream, but they could not have realised the advantages of such a course. The popularity of Bacon's philosophical works had changed men's minds, had made the Royal Society possible and successful.

Giving an account of the state which Science had attained at the time of Newton's first discoveries, Mr. Davey said that Copernicus had published his argument for the earth's motion in a circle round the sun in 1543 ; but scarcely any declared themselves convinced for a hundred years. Kepler had shown that the orbit was not circular, but elliptic ; and Galileo, by using the newly-invented telescope, had found that Jupiter had satellites, the moon an uneven surface, and Venus phases. Many denied the existence of such novelties ; one young man had seen spots in the sun, but his superior reproved him, saying, " I have read the works of Aristotle for many years, but never found any mention of spots in the sun ; the spots must have been in your own eyes." Others said they had looked for hours through Galileo's glasses, but saw nothing of his new stars or other discoveries. Such absurdity could obviously not last long. Other students here and there began to follow Copernicus, Kepler, and Galileo in appreciating the arguments for the earth's motion ; and by the middle of the 17th century the question was settled in the minds of scientific men. In this same 120 years, a very large increase had been made in the domain of mathematics. Two great inventions, Napier's logarithms and Descartes's algebraic geometry, had enlarged the Science ; and various attempts had been made to calculate curves, with which no progress had been made since Archimedes and Appollonius. Cavalieri, Fermat,

Pascal, and Wallis had glimpses of a new method of calculating. Galileo had made discoveries in applied mathematics far more important than his astronomical discoveries, which anyone with a telescope could see. He had formulated two laws of motion, the principle of virtual velocities, the law of acceleration of falling bodies, the parabolic path of a projectile, and the isochronism of pendular vibrations. Soon after Galileo's death, England, stimulated by Bacon's works, took the lead in experimental philosophy.

As yet no connected ideas upon the constitution of the universe had been evolved by the new Science. The old Ptolemaic system, now overthrown, was at least complete. Ptolemy has placed the earth in the centre of the universe; eight crystalline spheres surround it like the balls of a Chinese puzzle, containing successively the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, and the fixed stars. All these spheres continually revolved with incredible swiftness round the earth; and since they were all perfect, their motions took place in the most perfect figure, a circle.

This system, however, found a severe stumbling-block in the apparent irregularities that could be observed, owing to the complex and looped paths of the planets among the fixed stars; and additions of cycles, epicycles, and deferents were brought in explanation. This caused King Alphonso to say that if he had been consulted at the creation of the world he would have suggested several great improvements. Kepler supposed that the solar system was shaped like a wheel, each planet being on one of the spokes, and having an angel to push it.

So, when Newton began his career, a new mathematics was required for calculation, and a new system of the world was required to take the place of the Ptolemaic, which was at least consistent and complete, however false and clumsy. Newton produced both the new tools and the new results. After mastering all that was known of mathematics in his time, Newton, in 1665, produced that extraordinary weapon of Science, the infinitesimal calculus. But he did not publish it, and thus got into a very unpleasant controversy thirty years later. The advantages of this discovery were discussed at length.

The familiar story of the fall of the apple that led to the working out on such a tremendous scale of the principle of gravitation then came under the Lecturer's attention. Gravitation was known to exist on the tops of mountains, and at the bottoms of mines, and at every spot on the surface of the earth. Newton thought within himself, "Does it extend beyond the earth?" The ancient idea was that the centre of the earth attracted all heavy substances to it. This idea we find enunciated in Shakespeare's *Troilus and Cressida*, and in detail at the end of

Dante's *Inferno*, where the poet describes himself, under the guidance of Virgil, as reaching the exact centre where Satan is confined, then turning round, and climbing till he emerged at the Antipodes. The investigations of Galileo had shown that all bodies, apart from the resistance of the air, fall at exactly the same pace towards the centre of the earth, 16 feet in the first second. To generalise this fact beyond the earth was a guess, Newton's most wonderful guess; "anyone may make guesses at scientific results, but to guess correctly and prove the correctness is the work of genius only." Mr. Davey set out how Newton calculated the orbit of the moon, and to his great disappointment, found the fall towards the earth to amount to 18 feet instead of 16. He laid aside the subject for years in consequence, but accidentally heard at a meeting of the Royal Society that a fresh measurement of the earth had been made by Picard, who found that a degree of arc measured 69 miles instead of 60, as had been previously supposed. Then Newton returned to his labour, proved the truth of his guess, and showed that gravitation affected not only the earth, but was the force that held together the entire solar system. Newton also showed that the effect of gravitation would be to flatten the earth at the poles, to occasion the precession of the equinoxes and the phenomena of the tides; and that the masses of the heavenly bodies might be computed by it. Yet, however, these results might never have been published had it not been for Newton's friend, Halley, who himself brought the matter before the Royal Society, and paid the expense of printing the book.

The title of the work, which finally came before the world in 1687, was *Philosophiae Naturalis Principia Mathematica*,—Mathematical Principles of Natural Philosophy. It is commonly called the *Principia*. The very title of the work marked out its fundamental difference from all previous systems of the world. It was a mathematical attempt to explain the constitution of the universe.

In the first book of the *Principia* Newton showed mathematically what laws would result if bodies attracted each other by gravitation. The method is that of the ancient Synthetic Geometry; definitions and axioms are laid down, and successive theories and problems are solved. The most extraordinary portion is the wonderful sixty-sixth proposition, with its twenty-two corollaries. In the second book the method of fluxions (the calculus) is laid down; but Leibnitz had already published his form of the calculus. Finally, the third book, by the aid of the new mathematics, shows that all the known solar system actually does follow the laws which had been shown in the first book to rule if bodies attracted each other by gravitation. The demonstration was as complete as it could be made by human

means, and the poem which Halley prefixed concluded : " Nec fas est mortalibus proprius attingere divos." (It is not lawful for mortals to approach the gods more nearly.)

" What progress has been made since Newton's time in our knowledge of the universe ? " asked Mr. Davey. He answered by pointing out the development of the infinitesimal calculus by continental workers and the discovery of the differential equations of gravitational attraction. Except for this, and attempts to solve such equations, absolutely no discovery in gravitation had been made since Newton's time. The difficulty of computing the mutual attractions of three gravitating bodies is not yet absolutely overcome. If we had observations upon multiple stars, the problem would have to be faced in all its rigour. The principal need for advances in mathematics at present seems to be further progress in the solution of differential equations ; but probably an entirely new branch of analysis will have to be invented before this advance was of definite advantage. So thorough and complete is Newton's work.

In a concluding summary, Mr. Davey said that the rise of modern Science in the 16th century was considerably impeded by false views of what was desirable to study ; that, as far as the generality of thinkers was concerned, the nobility of natural Science was first made known by the writings of Francis Bacon, the Lord Chancellor, Court favourite, and Statesman who thought it not undignified to experiment, nay, even that the study of natural Science was the most important of secular employments. After his death, and during the political turmoil, Englishman after Englishman turned to the path whither Bacon had pointed, and finally the novel materials, quickly accumulated, were employed by a man of the highest genius, whose originality, in the words of his greatest successor, Laplace, " will assure to the *Principia* a pre-eminence above all the other productions of the human intellect."

WEDNESDAY, JUNE 14TH, 1899.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 14TH, 1899.

The Council has much pleasure in congratulating the Members on the continued prosperity of the Society, as shown not only by the membership being well maintained, but also on the admirable series of Papers and Lectures read or given before it during the past year. It is, however, matter for regret that the Lecture scheme to which allusion was made in the last Report did not receive from the public that support which would justify the continuance of the Lectures. In consequence, some loss has fallen on the Guarantors. The programme of Papers and Lectures for the Session 1898-9, which was circulated at the commencement of the Session, has been carried out in its entirety. It is hoped that the practice thus begun of publishing a programme will be continued. Two of the delegates appointed to attend the Meeting of the South Eastern Union of the Scientific Societies at Rochester (Messrs. S. Roberts and Breed) represented the Society there, and duly conveyed the invitation sent by this Society for the Union to meet in Brighton next year.

During the past year the Society has lost one Member (Honorary) by death, Mr. C. L. Prince, of Uckfield, and seven have resigned. Twenty-two new Members have, however, been enrolled, leaving a net increase of 14.

The Excursions have been as follows :—

June 11th.	Heathfield and Brightling.
" 25th.	Leonardslee.
July 16th.	Saddlescombe.

Papers read before the Society at its Ordinary Meetings :—

1898. Oct. 12th, Inaugural Address : Dr. TREUTLER.
" Nov. 11th, " Protection in Nature" : COL. SWINHOE.

1898. Dec. 7th, "Light - Holding Appliances from the Earliest Times": MR. E. LOVETT.
1899. Jan. 11th, "Microscopical Demonstration": MR. CAUSH.
 " Feb. 22nd, "Pain": MR. G. MORGAN, L.R.C.P., &c.
 " Mar. 18th, "The Skin of Liquids": DR. DRAPER.
 " April 26th, "The Röntgen Rays as an Aid to Scientific Investigation": MR. E. PAYNE, M.A.
 " May 10th, "Before and After Newton": MR. H. DAVEY, JUNE.

In addition to these, there have been the following Lectures, to which the public were admitted on payment:—

1898. Nov. 22nd, "Telegraphy, With and Without Wires," by DR. FLEMING; in the Pavilion.
1899. Feb. 16th, "Spiders: Their Work and Their Wisdom," by DR. DALLINGER; in the Dome.
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LIBRARIAN'S REPORT.

Only 90 books and periodicals have been lent out during the past year. This is the lowest figure reported for some years, and it is to be regretted that Members do not more frequently use the Society's valuable Library.

The Society is indebted to H. Willett, Esq., for the gift of Robinson's "Wild Traits in Tame Animals," London, 1898. A section of this work was read by the author at one of our meetings during the past year.

A number of large and valuable works have been received from the Smithsonian Institution, in continuation of the several series begun in past years.

The Society has also to thank Mr. W. Thorpe, of Ship Street, for kindly sending a volume which he had bought among a parcel of books, and which proved, upon inspection, to contain the Society's label. It is the Series of Gosse's "Romance of Natural History," and must have been lost for at least twelve years, as it did not appear in the Catalogue printed in 1886.

H. DAVEY, JUNE.,

Hon. Librarian.

BOTANICAL SECTION.

A Meeting was held on the 5th December, 1898.

Mr. Lewis gave an account of a visit to Norway, and plants added to the Herbarium during the year was examined.

At a Meeting on the 17th May, 1899, the Committee and Officers were re-elected.

Three evening Excursions were arranged for during the year, but only one was, through unsettled weather, successful. Six members attended, that to Hassocks sandpits and Clayton Downs, and some interesting specimens were collected.

T. HILTON, *Secretary.*

Since the last Report the following have been added to the Society's Herbarium of Sussex plants :—

<i>Erodium Cicutarium</i> , b. <i>chœrophyllum</i> .	Newmarket Hill.
<i>Zanichellia brachystemon</i> .	Sidlesham Mills.
<i>Zanichellia pedunculata</i> .	Rye.
<i>Prunus cerasus</i> .	Iford.
<i>Scirpus pauciflorus</i> .	Henfield Common.
<i>Enanthe silaifolia</i> .	Bury.
<i>Potamogeton friesii</i> .	Iford.
<i>Orobanche elatior</i> .	Iford.
<i>Chenopodium vulvaria</i> .	Shoreham.
<i>Agrimonia odorata</i> .	Storrington.
<i>Bunias orientalis</i> .	Hassocks.
<i>Rubus dumnoniensis</i> .	Seaford.
<i>Rubus echinatus</i> .	Race Hill, Brighton.

MICROSCOPICAL SECTION.

Two Meetings have been held during the Session, viz., on January 25th and March 29th, at the first of which Mr. D. E. Caush gave a demonstration of "Dark Ground Dry Mounting," and at the latter took up the subject of "Mounting Starch Grains, Pollen, &c., in Carbolized Water." Both demonstrations were followed by an exhibition of slides.

DOUGLAS CAUSH,
Chairman.

W. W. MITCHELL,
Hon. Sec. Micro. Section.

May 25th, 1899.

METEOROLOGICAL SECTION.

THE METEOROLOGY OF SUSSEX.

The accompanying Meteorological Report for the twelve months, July, 1898, to June, 1899, shows that England, and particularly its south-eastern portion, is still in the midst of the cycle of dry seasons which have prevailed with slight intermission since the end of 1886. This will be clear from the following figures of annual rainfall from 1887 onwards, which were as follows:—22·10, 28·16, 27·45, 28·61, 34·38, 26·47, 24·18, 31·95, 25·19, 27·84, 29·12, and 20·41. The annual rainfall of ten of these twelve years was below the average for 1877-98 (*i.e.* 29.45 inches), the lowest of the series being 1898. The total rainfall of the above twelve years was 320·8 inches. The amount if the rainfall had been equal to the average amount in the 22 years, 1877-98, would have been 353·4 inches.

These annually recurring deficiencies of water have caused considerable difficulties as to water supplies in the South-Eastern Counties. The Brighton Corporation have taken special steps to prevent the possibility of similar dearth in connection with the large area supplied with drinking water by them. New wells with large yields of purest water have been secured, and still further wells are in contemplation.

From the public health standpoint, years of deficient rainfall, which are nearly always associated with excessive heat, are always accompanied by an excess of the diseases against which hygienists have to combat. The elements in the last twelve years have certainly fought in the opposite direction to the preventive measures which have been in operation. The writer has shewn elsewhere that such diseases as rheumatic fever and diphtheria are more prevalent when dry seasons succeed each other without long continued intervals of wet weather. The same remark is true for scarlet fever, erysipelas, diarrhoea, and many other diseases, as proved by the vital statistics of every part of England and Wales.

The present Meteorological Report is deficient in respect of the absence of the usual comparison between the climatology of Brighton and Crowborough. This deficiency is, I regret to say, caused by the decease of Mr. Leeson Prince, who for a long series of years had carried out complete meteorological observations, first at Uckfield, then at Crowborough Beacon. These observations are probably the most complete and long continued of any in this part of England, and it is a deep cause of regret to all scientists, as well as to the personal friends of Mr. Prince, that the series is now broken by Mr. Prince's death.

ARTHUR NEWSHOLME.

TABLE I.

Brighton and Hove Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 14th JUNE, 1899.

Cr.

	£	s.	d.
To Balance in the hands of the Treasurer, 8th June,			
1898	7	4	0
" Annual Subscriptions and Arrears to 1st October,			
1898	5	10	0
" Annual Subscriptions to 1st October, 1899 ...	60	10	0
" Annual Subscriptions to 1st October, 1899 ...	0	10	0
" Entrance Fees	9	0	0
" Dividends on £100 2 <i>½</i> per cent. Consolidated Stock, for one year, to 5th April, 1899 ...	2	15	0

Dr.

	£	s.	d.
By Books and Periodicals	6	17	7
" Bookbinding	0	18	3
" Printing Annual Report and Abstract of Proceedings	13	10	0
" Printing and Stationery (General)	6	10	0
" Postages, &c. (General)	9	11	4
" Scientific Secretary, Honorarium for the current year	8	15	9
" Subscriptions to Societies	15	5	0
" Clerk's Salary	2	1	0
" Commission to Collector of Subscriptions	2	2	0
" Gratuities to Assistants at Museum	2	10	6
" Expenses of Meetings and Excursions	3	0	0
" Brokers' Charges on Transfer of Consols	8	15	9
" Fire Insurance Premium for Books	0	5	3
" Balance in the hands of the Treasurer, 14th June, 1899 ...	0	18	0

£85 9 0

£85 9 0

Balance in the hands of the Treasurer, 14th June, 1899 £4 7 10

There is a sum of £100 2*½* per cent. Consols invested in the names of the Hon. Treasurer and Hon. Secretaries, as Trustees for the Society.

Audited and found correct, September 4th, 1899,

F. GEO. CLARK, F.C.A.,
Hon. Auditor.

RESOLUTIONS, &c., PASSED AT THE ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was proposed by Mr. PANKHURST, seconded by Mr. Caush, and resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), the Librarian's Report, and the Reports of the Committees of the several Sections now brought in be received, adopted, and printed for circulation as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“Mr. J. E. Haselwood, Dr. A. Newsholme, Mr. D. E. Caush, Mr. E. J. Petitfour, B.A., F.C.P., Mr. J. P. Slingsby Roberts, Dr. E. McKellar, Dep. Surg. Geul., J.P., and Mr. A. G. Henriques, J.P.

And that in pursuance of Rule 42 the Council had appointed the following gentleman to be Honorary Auditor—

“Mr. F. G. Clark, F.C.A.”

The Secretary also reported that the following gentlemen who had been elected Chairmen of Sections would, by virtue of their office, be Members of the Council—

“*Botanical Section* : Mr J. Lewis ; *Microscopical Section* : Mr. D. E. Caush ; and that the following gentlemen who are Secretaries of Sections would also, by virtue of their office, be Members of the Council :—*Botanical Section* : Mr. T. Hilton ; *Microscopical Section* : Mr. W. W. Mitchell.

It was proposed by Dr. W. J. TREUTLER, seconded by Mr. J. C. CLARK, and resolved—

“That the following gentlemen be officers of the Society for the ensuing year :—*President* : Dr. W. J. Treutler : *Ordinary Members of Council* : Dr. A. H. Dodd, Mr. Harrison, D.M.D., Dr. F. J. A. Waring, Mr. J. Lewis, F.S.A., C.E., Mr. Payne,

and Mr. W. Clarkson Wallis ; *Honorary Treasurer* : Mr. E. A. T. Breed ; *Honorary Librarian* : Mr. H. Davey, Jun. ; *Honorary Curator* : Mr. B. Lomax, F.L.S. ; *Honorary Secretaries* : Mr. Edward Alloway Pankhurst, 3, Clifton Road, and Mr. J. Colbatch Clark, 64, Middle Street ; *Assistant Honorary Secretary* : Mr. H. Cane."

It was proposed by Mr. E. A. PANKHURST, seconded by Mr. H. DAVEY, Jun., and resolved—

"That the sincere thanks of the Society be given to Dr. W. J. Treutler for his attention to the interests of the Society as its President during the past year."

It was proposed by Mr. H. DAVEY, Jun., seconded by Dr. TREUTLER, and resolved—

"That the sincere thanks of the Society be given to Mr. E. A. Pankhurst, Mr. J. Colbatch Clark, and Mr. H. Cane, the Honorary Secretaries and Assistant Honorary Secretary, for their services during the past year."

And it was resolved on the motion of Mr. D. E. CAUSH, seconded by Mr. SLINGSBY ROBERTS—

"That the best thanks of the Society be given to Mr. E. A. T. Breed for his services as Honorary Treasurer during the past year."

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of
the Society :—

- British Association, Burlington House, Piccadilly.
- Barrow Naturalists' Field Club.
- Belfast Naturalists' Field Club.
- Belfast Natural History and Philosophical Society.
- Boston Society of Natural Science (Mass., U.S.A.).
- British and American Archaeological Society, Rome.
- Cardiff Naturalists' Society.
- City of London Natural History Society.
- Chester Society of Natural Science.
- Chichester and West Sussex Natural History Society.
- Croydon Microscopical and Natural History Club.
- Department of the Interior, Washington, U.S.A.
- Eastbourne Natural History Society.
- Edinburgh Geological Society.
- Epping Forest and County of Essex Naturalist Field Club.
- Folkestone Natural History Society.
- Geologists' Association.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- Leeds Naturalist Club.
- Lewes and East Sussex Natural History Society.
- Maidstone and Mid-Kent Natural History Society.
- North Staffordshire Naturalists' Field Club and Archaeological Society.
- Peabody Academy of Science, Salem, Mass., U.S.A.
- Quekett Microscopical Club.
- Royal Microscopical Society.
- Royal Society.
- Smithsonian Institute, Washington, U.S.A.
- South-Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- Watford Natural History Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS
OF THE
Brighton and Hove Natural History and
Philosophical Society,
1899.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 64, Middle Street, Brighton. When not otherwise stated in the following List the Address is in Brighton.

ORDINARY MEMBERS.

- ABBEY, HENRY, Fair Lee Villa, Kemp Town.
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- BEVAN, BERTRAND, Withdean.
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- BOOTH, E., 53, Old Steine.
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- BULL, W., 75, St. Aubyns, Hove.
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- BURCHELL, E., L.R.C.P., 5, Waterloo Place.
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- CAUSH, D. E., L.D.S., 63, Grand Parade.

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DAVEY, HENRY, Junr., 82, Grand Parade.

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EDMONDS, H., B.Sc., Municipal School of Technology.

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Dec 19, 1900

BRIGHTON AND HOVE
Natural History & Philosophical
Society.

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 13th, 1900.

Brighton:

J. G. BISHOP, PRINTER, "HERALD" OFFICE.

1900.

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JUN 10 1942

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The President.

Vice-Presidents.

(Rule 25)

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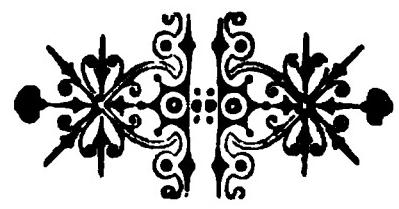
HENRY CANE, 64, Middle Street.

BOTANICAL SECTION.

Chairman: J. LEWIS, F.R.H.S. *Hon. Secretary*: T. HILTON.

MICROSCOPICAL SECTION.

Chairman: D. E. CAUSH, L.D.S. *Hon. Sec.*: W. W. MITCHELL.



SESSION 1899-1900.

WEDNESDAY, OCTOBER 11TH, 1899.

INAUGURAL ADDRESS

BY

PROF. G. S. BOULGER, F.L.S., F.G.S.

"Man's First Contact with Nature."

IT was not in the inhospitable barren northern lands that we should look for the cradle of the human race, but in a zone more luxuriant in variation, "the home of our collaterals, the tailless apes." There were a good many problems that arose over these beginnings of the human race.

Did primeval man, for instance, pass through a rudimentary stage of culture in which wooden implements alone were used, implements of which, from their perishable nature, no trace is likely to remain? Such a stage seems almost to be preserved to us in the existing condition of the Ainu of Northern Japan,—a persistent anthropological type, as it were,—the best description of whom we owe to that intrepid traveller, Mr. Savage Landor.

The Ainu cannot make pottery, and have no metallurgy. They use large shells as drinking vessels, and formerly used them also for shaving. They use needles of fish-bones, nets of twisted vine-stems, dug-out canoes with wooden anchors, bows each of one piece of yew, 50 inches long, with bamboo or bone-tipped arrows, and war-clubs only occasionally inlaid with stone. They care more for ornament than for clothing, tattooing themselves with cuttle-sepia or smoke-black, and wearing large metal ear-rings and glass necklaces, received in barter from the Japanese, Coreans, or Chinese, though they do not distinguish

gold from brass. The use of flint and steel they learnt from the Japanese.

But, perhaps, it is unnecessary to assume such a wooden stage, since we are assured that even the apes use stones as well as sticks, throwing them at intruders,—the most primitive welcome to strangers,—and also employing them to break cocoanuts. It is, however, interesting to remember in this connection that, apart altogether from the employment for that purpose of flints and pyrites, there is a primitive method of obtaining fire from sticks alone, a plan still in use among the Australian blacks; that throwing stick or boomerang seem more primitive than bow and arrow, and may well be at least co-eval with the stone celt; and that Mr. Lovett has described fish hooks made of thorns as still in use in Essex and on the French coast.

With regard to the first of these survivals it is well to bear in mind the lesson, which Mr. Kipling has emphasized for us in his Jungle Books, that the use of fire is undoubtedly one of the most distinctive and most progressive prerogatives of man. Fire existed, whether in the volcanic crater or lava-flow, or in the lightning flash that might ignite the prairie, before the real Prometheus brought it under human control. There still are some Australian tribes who are ignorant of any means of re-kindling a fire, having, if all their fires happen to become extinguished, to obtain a fresh light from another settlement. Perhaps folk-lorists might accept the suggestion even that the sacred office of the Vestal Virgins,—and perhaps even more persistent religious ceremonies,—preserve the memory of such a stage in the advance from barbarism; and it has been suggested that the two crossed sticks, one of which is revolved in that wide-spread instrument, the fire-drill, are the origin of that svastika or cross which figures as a sacred symbol in many diverse creeds."

Until man took to protecting himself from some more rigorous climate by the use of clothing, and invented a pocket, much private property and the incentive which the 'magic of ownership' would give to painstaking shaping of stick or stone implement would not exist. Theoretically the first 'implements' would be any stones to come to hand at the moment, to be used only at the time; then some selection of one better fitted by Nature for the purpose in hand might be made; and this, if man had a pocket, might be treasured, as might also one upon which some pains had been expended to shape it.

The sharp edge of a shell picked up on the beach and the broken bone of an animal that may even have died a natural death, or especially those hard limb bones split longitudinally, as even a jackal can do, for the sake of the marrow, suggest subsidiary weapons; whilst the stringy bark of a tree or the sinew of

an animal provides the wherewithal for the primeval lanyard which carried the celt, for the fastening with which it might be bound to a wooden handle, or for the string of the necklace of shells or teeth. The use of a pebble of the brook, whether as hammer or as projectile, is, Professor Boulger remarked, so simple that I do not think it necessary to assume that any time need have elapsed before man arrived at it.

Professor Boulger quoted from Dr. Semon's descriptions of the natives of Australia. All their weapons are "of stone, shell, bone, wood, vegetable fibre, and animal sinew." Their "culture stands on a level comparable to the stone age of our European ancestors. The use and treatment of metal is entirely unknown, though of course the tribes in communication with whites freely use the steel knives and tomahawks given to them, preferring them when once they have them to their clumsy self-made stone arms." The Australian, the Professor added, is entirely ignorant of pottery, nor does he practice agriculture in any form ; and Dr. Semon is of opinion that even the boomerang, the only object of native manufacture which is superior to anything of the kind made by other races, may have been discovered accidentally. But even the careful copying of such an accidentally-discovered pattern and the constant transmission of the type from generation to generation says something for their culture.

It is universally agreed that man in advancing from his primeval state is for a lengthy period in the nomad hunter stage before he takes to the pastoral or to the agricultural state. The evidence of remains seems everywhere to justify this conclusion ; and, though what has, perhaps unwisely, been called the Stone Age was certainly not in simultaneous existence in many countries, the similarity of the remains referable to it from different lands is undoubtedly remarkable. From Canada to Patagonia, from our own river-drifts to the Upper Nile and the laterite clays of India, the type is, speaking generally, the same. Yet undoubtedly the date of this stone stage of culture, and especially the date of its close, was totally different in the Valley of the Nile, in India, in Britain, and in Australia.

Some interesting speculations on the life of man in this dawn of the race were advanced by the Lecturer. He observed that "Canon Tristram long ago pointed out how Arab hunters to-day occupy caverns alternately with the hyæna, coming to hunt in a district until the game is exhausted, and driving out the four-footed troglodytes, who return on their departure. Kent's Cavern, Torquay, and many another pre-historic cavern bore testimony to an identical state of things in the remote past."

Now to these primitive hunters hunting was a necessity. We speak of it as "sport," of our quarry as "game" ; but to

them it was a very real struggle for existence. They had, at one time, to defend themselves against beasts of prey not to be eaten, and at another time to kill that they might eat. With such stimuli all the observant and reasoning faculties that the savage hunter possessed would certainly be brought to bear upon the chase. "First of all," says Dr. Louis Robinson, "he must have a general knowledge of natural phenomena, accurate and inconceivably extensive, so that when he is afield every item among his innumerable surroundings is so familiar that the least unusual circumstance at once arrests his attention. Next, he must have acquired, in addition to his general knowledge, a complete mastery of the complex art of tracking and stalking, so that he may approach near enough to his wary game for his rude weapons to take effect. If we go no further than this, we find that the untutored savage in his native wilds almost comes up to that formula which defines culture as "knowing something of everything and everything of something." But other gifts are required beyond mere knowledge and skill. There must be an infinite capacity for taking pains (which has been given as a definition of genius), and also, and above all, there must be a power to reason accurately from the facts observed. . . . We may be tolerably positive that our early hunting ancestor had the 'invariable and essential mental habit. . . . not only to gather facts, but to read their meaning, both immediate and remote.'" . . . Many people who have spoken with contempt of the mental capacity of the Bosjesman and the Black Fellow can never have estimated the mental resources required for ordinary 'spooing!' You may perhaps remember, said the Lecturer, that when Voltaire wanted to illustrate the logical methods of such a task, he imagined, not a savage, but, an Oriental sage, Hadig, that precursor of Mr. Sherlock Holmes whom Professor Huxley took as the type of the man of science.

Two instances were mentioned by Professor Boulger of the advanced technical skill of the hunter that have made some writers imagine that before the dawn of intellect man was gifted with varied instincts now replaced by ratiocination. Professor Daniel Wilson in his 'Pre-historic Man' figures a Fuegian harpoon which is slightly curved to allow, it is suggested, for the refraction of the water; and he quotes from a French traveller a circumstantial account of turtle-hunters on the river Amazon, who, knowing that if they shoot directly at the turtles their arrows will glance off the polished carapace, discharge them into the air so as to fall vertically upon the animal, surely a very remarkable achievement by mere empirical training of the eye as a substitute for any mathematical theory of projectiles.

Man's main considerations in his attitude towards Nature in this primitive stage being his personal safety and his imme-

diate requirements in the matter of food, and in the more rigorous climates, clothing and shelter, he would naturally be eminently materialistic and probably altogether devoid alike of most of that æsthetic sense exhibited in the perception and enjoyment of beauty, and of all that sympathy for the lower creation, which we now term distinctively humanity, which make up between them so much of our own feeling in the matter. As to the former of these, however,—the sense of beauty,—we have, seemingly, direct evidence, amplified by the analogies of modern savagery, that a love of personal adornment is—in both sexes indiscriminately—so primitive that we are tempted to believe that, though not so highly developed an instinct, perhaps, as that which has led to the sexual selection of the wondrous colour-schemes of insects and birds, there was an innate love of the beautiful in man, more comparable, perhaps, as that which has produced the colours of the mandrill. Perhaps, even here, however, we can trace a utilitarian origin. The necklace of shells or claws, or at a later period of beads, metal, or other objects, obtained perhaps by barter from some higher race, is so general among savages, and even in early entombments, that we think it must have had an innately æsthetic origin. Though the fossil echinoid, evidently carefully chosen as the handle of a flint implement, would be a means of proving ownership, or might become the primeval insignia of rank, its first choice, and the rows of ‘shepherds’ crowns’ and ‘snakes’ hearts’ round the skeleton in a barrow, seem alike to have arisen from that mere sense of the bizarre which is to-day an important element in our conventional notions of beauty. Is it not, however, possible that, as a white under-surface to the tail proves useful to the rabbit as a recognition mark, some feathers stuck in the hair of a chief as his oriflamme, or those painful slashings of the cheeks, or smearing or tattooing the body with pigments, may have been the strictly utilitarian origin of much personal adornment, which in later stages has become an object in itself?

As far as the Lecturer could tell, there was no evidence of domesticated animals during the Palæolithic age, but in later hunting periods arose a practice of keeping of pets, to which we might attribute the first softening of attitude towards Nature and the beginning of humane feelings. This led Professor Boulger to touch upon some difficult problems, whether any particular progress of the human race had originated in the mind of one great genius, a Cadmus, Triptolemus, Tubal Cain, or Sequoia, and had then been transmitted from tribe to tribe, whether by international trade or by conquest, or whether it had been reached independently in many times and places. These questions concerned alike the utilisation of fire, the art of polishing flint, the potter’s wheel, the lathe, the smelting of

metals, and the alloying of copper with tin,—steps of the very highest import in the early history of civilisation.

A consideration of the high state of civilisation reached by a race that seemed to have preceded the Egyptians led Professor Boulger into a disquisition of the possibility of there being a copper age preceding what is universally recognised as the bronze age. Gold was a metal known to the earliest of men, and it seemed probable that they considered copper equally valuable, if not the same thing. The Lecturer quoted Mr. Gladstone as looking upon a word in Homer usually interpreted as bronze as meaning copper, and he referred to other data as proving that at one time copper was the chief metal in use. Then there came the discovery of tin, and by some accidental circumstance, probably a big forest fire, man discovered that the metal could be obtained from the ore by fire, and that it could be alloyed with copper to make that much harder compound known as brass. Incidentally the Lecturer said that though the Phœnicians may have obtained casual supplies of tin from Britain, they probably obtained most of it from Mashonaland. However it came about, this discovery of the art of alloying tin with copper marked an important epoch in the history of mankind, since with the coming of bronze man passed from barbarism to civilisation.

WEDNESDAY, NOVEMBER 15TH, 1899.

Gilbert White, of Selborne.

MR. EDWARD A. MARTIN, F.G.S.

TO illustrate his lecture, Mr. Martin made use of a large number of well-executed lantern slides, mostly from photographs, and the lecture resolved itself as much into a description of the pictures, as the pictures were illustrative of the lecture. Mr. Martin impressed upon his hearers the great value to naturalists of Gilbert White's one book, and he deprecated the fact that it was so far from being appreciated now-a-days as it deserved. Gilbert White might really be termed the father of natural history, and, though the discoveries of later day scientists have made some of his book out-of-date, there still is a great portion of it that has not yet been superseded. Even

more valuable than the information imparted by the book, Mr. Martin thought, is its influence, as opening men's eyes to the study of all the forms of Nature that they find about them, and the example it holds out of what may be achieved by close, intelligent observation of what lies immediately about one in the inexhaustible realms of Nature. He wrote only one book, "The Natural History of Selborne," but that book had given him a sure niche in the temple of English literature. It is for us to follow his example, and, retiring into the woods and forests, drink in the healthy influence which the perusal of such a book brings to us.

As to Gilbert White's history, Mr. Martin told how he lived from 1720 to 1795, and was Curate at Selborne and the neighbouring village of Farrington. It was a time of considerable political unrest in England and on the Continent, the latter part of his life extending over the French Revolution, but Gilbert White went on undisturbed, placidly noting how the birds lived and the flowers grew, "more concerned with the course of events in building a marten's nest than in the crash of Empires." His famous book was originally not written for publication, but was made up of letters he had despatched to two friends of his during a considerable number of years. Eventually his brother persuaded him to have these letters collected and put into book-form, and so it was that "The Natural History of Selborne" was saved to the world. Most of these letters were written from Farrington and Selborne, but three are dated from Ringmer, in Sussex, with whose Down scenery Gilbert White was greatly impressed. Having only this limited area to draw upon, Gilbert White's opportunities in one way were limited, but it happened, fortunately for him and for us, that, if an observer's field of research had to be limited to one village, then Selborne was an ideal place for such an observer. Its peculiar geological position, at the extreme edge of the Wealden clay, where it was broken into by other formations, made it almost unrivalled as a place for "specimens" of all the kinds sought by the naturalist. Whatever came to hand Gilbert White studied most sedulously. His forte was ornithology, but he took note of and wrote upon everything that he could find, from fossils to rush-lights. The life of a country clergyman in those days was not very burdensome, and he had plenty of time to devote to his hobby. An amusing instance of the easy way the Clergy worked in the Georgian period was incidentally provided by the exhibition of a leaf of a sermon written by Gilbert White, which his diary showed he had used some twenty times. As to his thoroughness in getting the most he could out of the material at hand, the Lecturer mentioned that the number of fish he was able to examine was very few indeed, but he made up for it by the exhaus-

tive nature of his studies upon some gold fish belonging to a friend. His experiments with his famous tortoise, Timothy, also came in for remark.

Regarding Gilbert White's influence, Mr. Martin pointed out how much Darwin admitted owing to the naturalist of Selborne. Many men of science had taken to editing his works, down to Grant Allen, whose edition the Lecturer considered to be the best.

A good deal of the lecture was taken up with following out points suggested by Gilbert White in his book. For instance, his remarks on the sparrow led Mr. Martin into a short disquisition as to the utility of that much-abused bird. In towns, Mr. Martin thought, the sparrow's capacity as a scavenger made it invaluable; in the country, he left it as an open point whether it did more harm than good. Then the author's speculations on the relation between the animals of England and America brought Mr. Martin out with maps and diagrams to show that it was probable that in some prehistoric period England, Europe, and America were all connected by a belt of land that included Iceland.

Another section that figured prominently in the lecture, though Mr. Martin dealt with all incidentally, making no attempt to group them, was a description, from the Lecturer's point of view, of the topography and geology of the village of Selborne. Into this subject he went minutely, pointing out the objects of interest to be found in the village, and practically telling his audience all that there was to be said about them. In this task, evidently one greatly congenial to his tastes, Mr. Martin was materially aided by his numerous excellent photographs. He warned intending hero-worshippers that a tablet in Selborne Church saying that Gilbert White's tombstone "is the fifth from this wall," was altogether misleading. By some maladroitness, the tablet has been put in the wrong wall.

WEDNESDAY, DECEMBER 6TH, 1899.

Climbing the Andes.

SIR MARTIN CONWAY, F.R.G.S., &c.

IT was some eighteen months ago that Sir Martin, who has climbed mountains in many parts of the world, and is a Vice-President of the Alpine Club, set out to seek fresh adventures on the hitherto untrodden peaks of the Cordillera Real, in the Republic of Bolivia,—the Thibet of South America. The Lecturer commenced the description of his journey at the point where, on the upward way towards the mountains, he and his two Swiss guides set foot on the little steamer that was to carry them across the Lake of Titicaca. This extraordinary lake, many times larger than Geneva, and already some thousands of feet above sea level (though within appreciable distance of the Equator), they crossed with comfort. In so doing they were fortunate, for, as a rule, its waters are agitated by the most unpleasant storms, so that the voyager suffers not only from the rarefaction of the air, or mountain sickness, but from seasickness as well. The combination of the two maladies, Sir Martin assured his audience, was “one of the most insidious forms of illness it is possible to conceive.” Moreover, it is the rarest thing to find a person capable of becoming habituated to it. On the Titicaca steamboats passengers and crews are alike prostrated.

From the waters of the lake, across dark intervening mountains of lower level, the traveller and his comrades commanded a view of the white towering solitudes they had come to explore, masses of gleaming ice piercing the blue equatorial sky. Mount Sorata towers at the north end of the Cordillera, more than 20,000 feet above the sea, while in the giant Illimani, invisible as they approached from the lake, the range culminates at the southern end. Beautiful photographs, of glacier, gorge, and rearing peak, were thrown upon the screen as the lecture progressed.

Lake Titicaca and the district round about was the original home of the great Inca civilisation. Indians of pure Inca blood still inhabit the region, having the civilisation no longer, but

speaking the same language as in the old days of power, telling the same wild legends, retaining the same religion,—just varnished over with a little Christianity.

Finding the northern face of the mountains impossible, Sir Martin Conway took up his headquarters at the town of La Paz, from which he set out to climb Sorata and Illimani. Mules could be employed to a height of about 14,000 feet, after which the baggage had to be carried on the backs of men, while in the actual snowy region itself they had to do with very little baggage.

Incidentally the Lecturer mentioned that all this mountain region was rich in mineral deposits, though these were as yet little worked, in consequence of the lack of fuel and the difficulty of getting at them. Of one place, where an American Company had taken possession of a "basin" in the rocky valley, he showed photographs. Down the basin ran a mountain stream, and the sides of the basin were rocky walls, towering hundreds of feet. All the Company's machinery had to come down a narrow path, over whose precipitous edge the sure-footed mules would sometimes slip and fall, bouncing from boulder to boulder, till they crashed, broken and bleeding, on the basin bed far below. High up above in the mountain they had cut a canal between two mountain streams, and from the canal to the basin below had run an iron pipe, four feet in diameter at the top, diminishing gradually to an orifice at the bottom eight inches in diameter. Through this orifice, which could be turned in different directions, the tremendous downward pressure of gravity exerted, through the water, a force equivalent to some 8,000 horse-power, and by this means the bed of the stream was washed through sluices. When all the basin had thus been worked, the place would be abandoned, and the wall would remain, for perhaps thousands of years, "a monument to the interest the people of the 19th century have taken in finding gold."

On the long laborious journey up, the adventurers came to a spot when it seemed as though hopes of winning the principal peak must be abandoned, for the great snow-field that led up to the highest point of the mountain ended in long walls of ice that hung over like the end of a spread table-cloth. To approach beneath this ice was to court annihilation, for ever and anon vast masses would fall crashing from the heights, shivering upon the rocks and precipices, and bounding off down the mountain's flanks in great avalanches of ice that broke into ever smaller pieces till it became a fine dust. At last they heard of a valley by which they could mount higher, and for several days pursued their way up a drift of loose rocks, similar, in the photograph, to those that strew the upper portions of the Welsh hills. They had now reached uninhabited regions, and the

Indians who carried the baggage were getting nervous. As in all mountain regions, the people firmly believed that the uninhabited zone of the mountains was the abode of devils. Every one of the great stones that lay along their present track had, the Indians maintained, been kicked down by a devil. Whenever they heard a rock spring loose and come tumbling from above, they looked up anxiously to see the devil. The theory of these devils was much against rapid progress. Wherever the Indians could they sat down. Sir Martin estimated humorously that they sat down 50 minutes in every hour at this part of the ascent. At last, however, the poor Indians could stand their diabolical surroundings no longer, and at one camp they all ran away, except two, more daring than the rest, who remained for the novel experience of sleeping in a tent. But these also began to be overcome by fears, and hung back when the party came to an extra bad place. "Fortunately I had brought with me a lot of silver coins, and I would go fifteen or twenty yards ahead and hold out a coin, and they would come and get it, and then I would go on a little further and hold out another, and so on, and as we got higher and higher the silver coins had to get bigger and bigger. But finally we came to a very bad place, but they no longer took any interest in dollars, and nothing could get them any higher. And some hours later faint howls of delight came up to us through the still air, telling that they had got safely off the cursed rocks again."

So Sir Martin Conway and the guides had to do their own carrying now. In these high altitudes the air was so rarefied, and the amount of oxygen breathed at each inspiration so small, that merely to get about was exhausting. Half-an-hour's work in such a light atmospheric pressure fagged one as much as five hours' work at a lower level. Sir Martin had brought away some wonderful mountain views,—seas of cloud, filling the valleys beneath like snow, and cutting off the great peaks "in icy isolation."

Perseverance had its reward in the discovery of a place where the ice cap, that hung from the snow-field crowning the mountain, sloped down in a steep glacier instead of hanging overhead. Here they made their way up, and, about a quarter of a mile in upon the snow-field, they pitched their highest camp. At two o'clock in the morning they set forth to mount the snow-field to the peak itself. But their difficulties were not yet all over, for they discovered another peak between them and the one at which they were aiming. This they had to cross, and the intervening snow-field, till at last, after one of the most toilsome half-hours in their experience, they mounted the top-most summit of Illimani, and before their eyes, though clouds

were gathering, a vast panorama lay stretched for two hundred miles. Standing there, more than 21,000 feet above the sea, they spent an hour planting their little Union Jack,—soon to vanish in the tempests of the mountain top,—and assimilating the sensation of standing where no human foot had stood before.

As for the return journey, Sir Martin was very brief. With humour of the American kind he described the return journey of what baggage they had taken to the summit, and no longer required. "We wrapped it all up in a bundle, and rolled the bundle to the edge of an ice gulley. Then we let go, and it slithered down, and soon began to make little jumps along the ice. Then it jumped fifty yards, and then half a mile, and then twenty miles, and then it scattered like a lyddite shell all over the country of Bolivia. When I passed my sleeping bag again on my way down there were eighteen different ways of getting into it."

Sir Martin shortly described his ascent of Mount Sorata, a similar adventurous journey. For the ascent of Sorata in the higher altitudes they carried up a small sledge, for greater convenience of conveying the baggage. They found, however, he and his two guides, that it was all their work to get along. Sir Martin made the discovery that by a wise dispensation of Providence no man could pull a sledge and take a photo of himself doing it at the same time. "Therefore, as we got higher, you will see that it became more and more necessary to take photographs." Every now and then they would come to a flat spot, and sit down, and say what a nice thing it was to have a sledge to sit on. When nearing the top of Sorata they had to stop for a snow-storm. They waited a day, but it kept on, and they had to leave their camp and bolt for their base camp as hard as they could. And it was just as well, for that snowstorm lasted three weeks. Then they returned and found their tent, and started for the peak again in the black night. The final slope of Sorata they found most treacherous with the newly-fallen snow. At each step they would sink to the chin, and had to stamp the snow down to get a footing, and all the time they were in imminent peril of creating an avalanche of the loose snow. The last hundred feet or so, which in ordinary circumstances would have only taken about a quarter of an hour, they found quite impossible, and there was nothing to do but turn back. As the peak was covered with clouds they had lost nothing but the sentimental satisfaction of actually standing upon the peak itself.

WEDNESDAY, DECEMBER 18TH, 1899.

DISCUSSION

ON

The Association of Members for the Study of some Unexplained Phenomena,

OPENED BY

MR. HENRY DAVEY, JUN.

WEDNESDAY, JANUARY 10TH, 1900.

Old Sussex Iron-Work.

MR. J. LEWIS, F.S.A.

THE lecture dealt with the flourishing iron trade of which Kent and Sussex were at one time the centre. It called up visions of a Weald, not dreaming away the years in a rural beauty changing its aspect only with the changing seasons, but belching forth fire and smoke from a score of great furnaces and foundries, and so devastating the country side that special legislation had to be enacted to protect the trees from being all used up to feed the flames. The lecture was illustrated by a number of lantern slides.

It seemed, said Mr. Lewis, hardly possible that rural Sussex was at one time the seat of a great iron industry, and, considering the extent to which that industry was carried on, it was singular that, till 1844, no one had thought it necessary to investigate its rise and fall. Speaking generally, the use of wrought iron marked the stage in the evolution of races which followed what we call the "bronze age," but the casting of iron,—the melting of it in the furnace and the forming of it in moulds,—marked a far greater advance in knowledge. The origin of the iron working in Sussex, however, seemed quite lost.

To give his audience some idea of the terrific heat necessary to melt iron, Mr. Lewis had prepared a little table. The mere figures, he said, would of themselves be unable to give any adequate notion, but let his hearers take, as their starting point, the heat of boiling water. Boiling water, though the heat of it was sufficient to cause people to make "cursory remarks" if they got a splash of it by accident, was a mere nothing by comparison with the temperature of melting iron. Water boils under ordinary circumstances at 212 deg. Fahrenheit. At 594 deg., more than double that temperature, lead fuses. At 1,842 deg., more than double this again, iron is at "welding heat," and may be hammered into shape. But even this great heat must be again more than doubled before we get to 2,786 deg., the fusing heat of iron. By what mechanical contrivance the earliest iron-casters of Sussex had obtained this enormous temperature no one as yet knew. It had been suggested, in regard to other ancient peoples who had known how to cast iron, that the winds of heaven had been pressed into service to supply the blast for the furnaces, but in view of the comparative moderation and the uncertain direction of the winds in Sussex, Mr. Lewis was inclined to doubt very much whether this could have been done here. In fact, he did not seem very much to favour the idea at all, for in India, where from ancient times iron had been worked, and where there was a hot, steady wind for many months together, the natives had told him that it was impossible to melt iron, and when he had described the process to them, they had merely looked upon him as an unusually talented liar.

It was archaeology alone which threw any light on their subject. There was in the Museum at Hastings a little iron statuette about six inches high, of the date of the Roman occupation, which the best authorities agreed was cast iron. Mr. Lewis showed a photograph of it,—a rusted, time-worn, featureless little figure, with one leg missing. However, as he remarked, "in these things you have to take what you can get." Other Roman remains there were, such as coins and other articles, which had been discovered in the remains of furnaces, where there was no evidence of the presence of anything mediæval; which pretty conclusively proved that the Romans had found a way of melting iron and casting it in moulds. At the remains of an ancient furnace at Beaufort Park a coin of Hadrian had been found, while at Maresfield, coins, of dates ranging from the reign of Nero to Diocletian, had been unearthed. A photograph was shown of another ancient working at Hastings, the place round where the fires had roared long years ago being now well-wooded and grown with weeds and flowers. With the departure of the Romans for good, and the advent of the Saxon, the iron industry in Sussex may have

fallen to a very low ebb, for Domesday Book, that exhaustive and invaluable record compiled after the Norman Conquest, contains no mention of it. However, there is a record in Lewes going back to the year 1266, stating the amount then to be paid on every load of iron brought into the town. To those who read the evidence, Mr. Lewis said, it was perfectly plain that this referred either to wrought iron or to pig-iron brought in on purpose to be worked.

The re-discovery of the art of casting iron was practically a modern invention. The trade seems to have been revived in the Fourteenth Century by the finding out of a method of melting the metal and running it into moulds. The discovery, which Mr. Lewis thought was probably due to an accident similar to that which led to the discovery of glass, was not, he said, proved to have been made in Sussex. However, as the English under Edward III. were the first people mentioned as users of cannon in war, it was reasonable to suppose that they were the first to cast iron shot.

An interesting part of the lecture was that dealing with the manufacture of the early cannon in Sussex. The first cannon cast in one piece was made, Mr. Lewis said, by a Sussex man with the characteristic Sussex name of Hogg, at the village of Buckstead. About the middle of the Sixteenth Century many names of Frenchmen and Germans are found in our County Parish Registers. These men, the Lecturer thought, probably came to Sussex to study the art of iron casting. There was a famous furnace at Lamberhurst. Comparatively few people were aware that the fine railings round St. Paul's Churchyard were cast at this same Sussex furnace at Lamberhurst. They are the greatest existing remains of the Sussex iron industry. Their weight, including the seven gates, is about 200 tons, and it is said that they compose, perhaps, the most magnificent balustrade in the world. They cost £11,202. But the Lamberhurst foundry was not always such a patriotic institution. Some of the cannon cast in it were smuggled from the seashore for use in French privateers, until such infamous traffic came to the knowledge of the authorities. One of the old Sussex cannon was shown in the illustrations,—a rude iron cylinder bound round and round for half its length, and supported on a couple of wooden beams, a curious embryo of the finished modern engines of destruction.

In the Sixteenth Century the Sussex ironworkers began to turn their attention to ornamental work for interiors. To this period belong the fire-backs and fire-dogs to be seen in many of the old country houses. The Lecturer had received from Mr. Henry Willett the loan of the only known Sussex fire-back pattern now existing. He showed it to his audience, who were

much interested in the relic. From the iron trade of the Sixteenth Century, he went on to say, many of the Sussex County families whose names are so well known to-day took their rise. Even the great Elizabethan nobles did not disdain to have large interests in the industry. So extensive did it become in Elizabeth's reign that at one time it threatened the existence of the timber in the Weald, and laws had to be specially passed to save the trees of Sussex. In the Seventeenth Century the growing scarcity of wood, the opening of the iron industry in Wales, and other causes, gradually combined to kill the Sussex iron workings, till in 1809 the last Wealden furnace ceased to burn. Last century the iron trade kept 42 forges and 27 furnaces in full activity, but, as Mr. Lewis remarked, few who know their Sussex of to-day will regret the transference of the "black industry" to another region.

WEDNESDAY, APRIL 11TH, 1900.

The Unconscious Work of the Mind.

DR. R. J. RYLE.

DEFINITIONS of the science of psychology, said Dr. Ryle, generally tell us that the science has to do with "consciousness as such," irrespective of what may be called the contents of consciousness. Such an account, however, fails to do justice to the fact that a large amount of work goes on which cannot be fairly called anything else but mental work, and it goes on unconsciously. Professor Lloyd Morgan introduces his discussion of this branch of the subject by drawing an analogy between the objects before our minds and the objects before our microscopes. In each case there is only a certain limited area of the field which is in focus (unless the object examined is destitute of thickness). Many details besides those upon which we concentrate our attention may catch our eye, but only indistinctly; and it seems that this field, of which we are only dimly conscious, forms a borderland between what is distinctly held in consciousness and what is quite (to use a modern psychologist's phrase) below the threshold of consciousness. Another Professor of the

same science describes the phenomenon under the similitude of a "fringe." He points out that around any distinct piece of mental work, such as the recollection of a person or place or a portion of poetry, there is an indistinct margin or "fringe," representing a region in which our minds are working, but working without our cognisance. The process which goes on when we endeavour to recollect a lost line of a quotation, and by which it comes into our heads, affords an illustration familiar to most of us.

The natural history of memory gives us, perhaps, the readiest examples of unconscious mental activity, but we may find them in all departments of our mental life. For instance, if we analyse with care the process of perception, we find that we are doing a great deal more than we are aware of. Take as an example the case of a house perceived. There are colour sensations, sensations of light and shade, sensations of form, sensations also corresponding with the objects around and beyond the house. All these are put together, to use an apt expression, as if by a secret chemistry of the mind, so as to form a definite object of consciousness, having its appropriate place and character in space and time.

Another common instance of unconscious mental activity is afforded by the work of the extempore speaker, who, with an unconscious, or at best only partly conscious, attention to an underlying thread of connection, chooses his words and sentences to accord with his varying topics and the attitude of his audience. Poets also testify to the presence of unconscious mental activity, and the late Cardinal Newman has given an eloquent testimony to the reality and importance of this aspect of mind in an Oxford sermon preached more than fifty years ago.

Analysis of the details of unconscious mental work is naturally of extreme difficulty, but, by following up all the clues we can find, it seems probable that a large part of the unconscious mental work which we do consists in the forming the dissolution and the re-arranging of associations between the ever-changing elements of our mental life,—the sensations, ideas, conceptions, volitions, and so on. Evidence in favour of this seems to be found in the process of mental development in childhood, and in an examination of the acquirement of many of our common accomplishments. The facility with which we leap from rock to rock, judging our distance, and co-ordinating the muscular effort accordingly, involves the operation of an activity, which has, no doubt, its physiological accompanying conditions of stimulus, of reflex, of inhibition, of co-ordination, &c., in the cerebro-spinal system, but it is an activity which (involving as it does such items as "less" and "more") can hardly be described appropriately except in the language of psychology.

Another point to notice is that we have not only to allow of the presence of unconscious mental activity, but we have also to allow that it is difficult to say quite where it begins and ends. The experience of sleep and dreams and the consideration of our common acts of will and imagination as well as those of attention all combine to show that the conscious activity of mind rounds off gradually and imperceptibly into the unconscious. The implications and consequences of the admission of unconscious mental activity count for something in many different directions. Autobiographies, books on logic, works of fiction, confessions of mystics, all contribute material to the study of the subject.

WEDNESDAY, FEBRUARY 14TH, 1900.

The Rhythm of Nature.

DR. C. H. DRAPER.

SOME examples of rhythmic motion are familiar to everybody. The motion of the waves of the sea, the ebb and flow of the tide, the beating of one's pulse are instances. The tides are a most interesting instance of one of Nature's cycles. The moon by her attraction heaps up beneath her 22,000 cubic miles of water and this huge lump follows her perpetually round the world. Yet not altogether perpetually. Every activity contains within itself the source of its own change, and slowly but surely the motion of the tides is stopping the motion of the world. They act as a brake on this revolving earth, and in consequence, one day, there will be no more days and nights and no more tides.

But there are rhythmical processes which more intimately concern us. Those for instance by which we hear and walk and talk. In fact, on rhythmical motion most things human depend. Before us is a pendulum swinging. The pendulum of an ordinary eight-day clock moves from side to side in one second. Could we move our hands backwards and forwards thirty times in a second, that motion would produce a low musical note. Look at the beating of the heart. "The heart contains within itself a something," says Huxley, "which causes its different parts to contract in a definite succession and at regular intervals." This successive contraction of the chambers of the heart takes place for each of us 37 MILLION times per annum.

Music is essentially rhythmical. Sound without rhythm is noise. The ear is gratified when the sounds succeed each other at definitely recurring intervals. The pendulum swinging before us has its own special rate of vibration. So long as it is as it is, and where it is, it will vibrate at the same rate and no other. This principle is of general application and musical instruments are based on it. The columns of air in the pipes of an organ have their own determined and definite periods of vibration. Dr. Draper showed many experiments illustrating this.

The drawing of a violin bow over a string presses the string slightly out of its position, the string springs back again, and these motions produce a noise pleasant or otherwise, according to the regularity of their recurrence. The musical note produced by rubbing a finger over the edge of a glass bowl, the air in the bowl responding to the vibrations in accordance with its own, the singing of a rifle bullet as it passes through the air, the singing of a tea kettle produced by the bubbles of steam rising through the water and bursting, are all instances of the same rhythmical motion. The note produced by a metallic plate which has been struck is beautifully shown by the figures into which sand strewn on its surface is thrown. The higher the note the more complex the figure, because of the more frequent the vibrations.

How is it we hear each other talk? The tongue so often spoken of as an unruly member, is not, strictly speaking, the organ of speech. People have been known to talk after their tongues have been removed. The apparatus by which the sound of the voice is really produced is the larynx. Through the aperture termed the glottis the air is continually passing. The size of this aperture is determined by the vocal cords. It is this which determines the character of the sound we utter. The vibration of the air thus produced reaches the delicate membrane within the ears of those listening to a voice, these are passed on to the nerves of the brain, and the voice is heard. These vibrations are at the rate of from one to three hundred per second, both in the person transmitting, and, of course, in the ear of the one receiving the sound.

Music can be appreciated by people who are deaf. Beethoven was deaf for a great part of his life. He used to sit with a stick pressed against the piano, the other end against his teeth, and he could hear the sounds produced by his instrument. Think of the multitudinous wave systems crossing each other in a room during a concert. From the vocal organs of the men proceed waves of from six to 12 feet in length. The higher voices of the women produce waves from 18 to 36 inches long. Each instrument in the orchestra emits its own peculiar waves. They are all again reflected from the walls of the room, and

rush backwards and forwards until destroyed by newly generated sound-waves.

But sound itself is but a sensation perceived by living beings endowed with special apparatus for the reception of those vibrations which cause it. OUTSIDE THESE LIVING BEINGS THERE IS NO SUCH THING AS SOUND. THE WORLD ITSELF IS PERFECTLY SILENT; ALWAYS AND EVER. The final secret of Nature appears to be motion. From this she constructs our world.

We pass from sound to light, and we are still in the domain of vibrations.

The rhythmical motion of the waves of the ether give to us light and colour. The intense physical and chemical changes going on in the sun affect the ether, in which the sun is immersed, and travel through it in multitudinous vibrations and with terrible speed until they reach our eye. But OUTSIDE THE SENTIENT EYE THERE IS NO LIGHT—only motion. THE NON-SENTIENT UNIVERSE IS NOT ONLY SILENT, IT IS UNUTTERABLY DARK. But motion is everywhere. When the ether vibrates at the rate of 400 million millions per second, the eye perceives red light. At about double that frequency we see violet light. Above or below these we see nothing at all.

Heat, light, electricity, all result from the rhythmical vibration of the ether.

FRIDAY, MAY 11TH, 1900.

Fluorescence and Allied Phenomena.

E. PAYNE, M.A.

SCIENTIFIC men have come to the conclusion that light and electricity are identical in their nature, that all light is an electrical phenomenon. This was the statement with which Mr. Payne opened his lecture, and, in order to show why they had come to this conclusion, Mr. Payne, who was provided with an excellent set of electrical apparatus, performed, for the benefit of his audience, a number of the experiments which had led the scientists to such a position.

If we accepted light as being electricity in a state of vibration, there was, he said, no difficulty in understanding the fact, which the spectrum revealed, that there were degrees of light

which our eyes could not appreciate, just as we knew that there were vibrations of sound that our ears could not appreciate. A ray of light, split up in the spectrum, revealed the existence, at either end of the visible part of the spectrum light, rays which in the ordinary way could not be appreciated by the eye,—rays at the red end, which produced heat, and rays at the violet end, which were light rays known as the “ultra-violet” rays. It was found, however, that certain substances possessed the power of making these rays perceptible. Conspicuous among these was fluor spar, upon the surface of which curious rays could be seen playing. “Fluorescence” was the name at first given to this peculiar property of fluor spar. A similar property in the opal was known as “opalescence,” but scientists, recognising the effects to be of the same nature, now preferred to call the quality “luminescence” wherever it occurred. These strange surface rays were the invisible “ultra-violet” rays converted into visible rays by the peculiar property of the surface of the substances. On his table Mr. Payne had a number of solutions of different “luminescent” substances, which in the ordinary light appeared of one colour, while, when a strong light was thrown upon them, they gave off their strange rays, and appeared of quite a different tint. Some “luminescent” substances, even after the light had been removed, retained, Mr. Payne explained, their “luminescent” colour. For the purpose of illustrating this he had placed a number of pieces of such substances in partly exhausted tubes. Informing his audience that a strong current of electricity passed through “luminescent” substances at once brought out their peculiar qualities in a more conspicuous manner than ordinary light, he went on to perform a number of beautiful experiments with the substances in the tubes. Among these were rubies, which, when the magic current was turned on, glowed like living scarlet; bits of marble, which shone under its influence with a bright golden light; and a bit of calcined shell. Then there was what he called a “fancy tube,” in which he had placed a variety of substances with “luminescent” effects of different colours. The result of the passing of the current through this was a beautiful effect in purple and red that was not unlike a vividly luminous thistle flower. When the current had been switched off, the brilliant glow gradually died out, like the glow of a cooling ember. Mr. Payne was careful to point out that even when the glow was brightest the substances were quite cold.

It was, he went on to say, in the course of investigations of the phenomena of fluorescence that the strange effects produced by the “X” rays were stumbled upon. Professor Röntgen had succeeded in discovering how, by means of the current in the vacuum tube, to transfer the “cathode” rays set up within the tube to outside it, so as to render “fluorescent” a screen of

platino-cyanide of barium at a short distance. In experimenting with this screen, he noticed that certain solid substances, even if interposed directly between the tube and the screen, did not prevent the "fluorescence" of the latter. Rays must, therefore, have penetrated the intervening substance, and to these unknown rays he gave the ordinary scientific denomination of an unknown quantity, and called them "X" rays. The action of these rays was brought home to the audience in a striking way by Mr. Payne, who, having entirely covered his luminous vacuum tube with some red silk, so that practically no light was emitted, held up the platino cyanide of barium screen, which immediately glowed with its pale green "fluorescent" light. "Luminous" paint, the fairy lanterns of the glow-worm and the firefly, the myriad sparkling of the tropic seas, and the baleful green of a cat's eyes in the dark, were all, he said, more or less "luminescent" phenomena.

WEDNESDAY, MARCH 4TH, 1900.

EVENING FOR MICROSCOPES.

REPORT OF THE COUNCIL

For the Year ending WEDNESDAY, JUNE 13th, 1900.

IT will be remembered that last year an invitation was conveyed from this Society to the Congress of the S.E. Union of Scientific Societies, then meeting at Rochester, to assemble in Brighton this year. This invitation, conveyed by our delegates, Messrs. Slingsby Roberts and E. A. T. Breed, was duly accepted, and the Congress accordingly met here on the 7th, 8th, and 9th inst.

Between 20 and 80 delegates attended from Societies affiliated to the Union, and about 80 tickets were taken by members of this and other Natural History Societies and strangers.

At the General Meeting of Delegates held on the 9th inst., a hearty vote of thanks was passed to this Society for the efforts made by it for the entertainment of the Congress, efforts which, the delegates were pleased to say, had been so far crowned with

success as to make the Brighton meeting one of the most successful ever held.

The members were received by Sir John Blaker, acting for His Worship the Mayor (Mr. Alderman Stafford, J.P.), who was absent from Brighton on the evening of June 7th, and by the Mayor and Mayoress of Hove (Mr. Alderman Colman, J.P., and Mrs. Colman) on the following evening at the Hove Town Hall. Mr. Colman also kindly provided a Lecturer in the person of Mr. K. Enoch, who delighted his audience with "The Wonders and Romance of Insect Life." The Members of the Union and Associates were entertained by the Executive Committee at tea at the Pavilion on Friday evening, and also at the Booth Bird Museum on Saturday afternoon.

The Society is greatly indebted to Mr. J. Williamson, of Hove, for his exertions in connection with the Exhibition of Photographs, &c. It was due to him that such an admirable collection was exhibited in the King's Apartments.

The Council has much pleasure in chronicling the generous gift by Mr. Haselwood to the Society of a handsome bookcase, together with 328 volumes of valuable books. At a recent meeting of the Society a special vote of thanks was given to Mr. Haselwood for his munificent gift, and means were ordered to be taken for securing a permanent record of Mr. Haselwood's generosity.

It has been found advisable to propose an alteration in the Rule which decrees that the President and Council who are elected in June shall retain until October. As the arrangements for the Session are in a great part made previous to the assembling of the Society in the second week of October it has been thought right that the President and Council who are in office during the year should have the responsibility of deciding on the Programme for the Session. The alteration proposed in the new Rule will have this effect.

Mr. Lomax, having ceased to be Curator of the Museum, Mr. Toms and Mr. Hilton have been made Joint Curators of the Society's collections. The best thanks of the Society are due to Mr. Lomax for the work he has done for the Society during the many years he has acted as Curator.

During the year which has passed, the Society has lost four members by death, and four by resignation.

Sixteen new members have joined.

The papers read before the Society have been as follows:—

- 1899. Oct. 11th. "Man's First Contact with Nature": PROF.
BOULGER, F.G.S., &c.
- ,, Nov. 15th. "Gilbert White, of Selborne": MR. E. A.
MARTIN.

1899. Dec. 6th. "Climbing the Andes": SIR MARTIN CONWAY.
 ,, Dec. 18th. Discussion, opened by MR. HY. DAVEY.
 1900. Jan. 10th. "Old Sussex Iron Work": MR. J. LEWIS, F.S.A.
 ,, Feb. 14th. "The Rhythm of Nature": DR. DRAPER.
 ,, March 4th. An Evening for Microscopes.
 ,, April 11th. "The Unconscious Work of the Mind": DR. R. J. RYLE.
 ,, May 11th. "Fluorescence and Allied Phenomena": MR. E. PAYNE, M.A.
 ,, June 18th. Annual General Meeting.

Excursions:—

1899. July 15th. Buxted.
 ,, July 24th. Old Place, Lindfield, by kind invitation of C. E. Kempe, Esq.
 1900. May 12th. Hassocks.
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LIBRARIAN'S REPORT.

During the past year 111 books and periodicals have been lent out to Members of the Society, an increase on the previous year; but it is still to be regretted that only a small proportion of the Members use the opportunities for study which the Society's Library affords them.

The munificent gift of a bookcase and books from Mr. J. E. Haselwood, alluded to in the Annual Report, is at present, by kind permission of the Brighton Town Council, housed in the main building of the Royal Pavilion. It will be transferred hither when the New Library is built, which may be expected in 1902. Upon the transference, a new Catalogue will be issued detailing these acquisitions.

The following works have also been kindly presented to the Society:—

Martin, E. A., Bibliography of Gilbert White (Presented by the Author).

Gaudry, Albert, *Les Ancêtres de Nos Animaux dans les Temps Géologiques*, Paris, 1888.

Topinard, Paul, L'Anthropologie, Paris, 1876 (Presented by Mr. Toms, of the Brighton Museum).

Besides the usual exchanges and periodicals there has been also acquired a work of local interest:—

Hudson, W. H., Nature in Downland.

These four works have been numbered 1841-4.

A large number of most valuable publications have been received from the United States Government and the Smithsonian Institute.

H. DAVEY, JUNR.,

Hon. Librarian.

BOTANICAL SECTION.

Chairman—J. LEWIS, F.R.H.S.

Secretary—T. HILTON.

Committee—Miss CAMERON, Mrs. CRAFER, J. H. A. JENNER,
G. MORGAN, L.R.C.P., G. HICKLEY, H. EDMONDS, B.Sc.

At a Meeting of the Section on the 25th May, 1900, a Committee was appointed for the ensuing year.

One evening Excursion to Shoreham was well attended and successful.

T. HILTON, *Secretary.*

The following rather uncommon Plants have been added to the Society's Herbarium since last Report:—

Botrychium Lunaria (Moonwort Fern).	Dyke Hills.
Alopecurus bulbosus.	Cuckmere Valley.
Vicia Bithynica.	Cult. land, Stanmer.
Coriandrum sativum.	" "
Ranunculus fluitans.	Chichester Canal.
Enanthe pimpinelloides.	Bosham.
Utricularia vulgaris (Great Bladder-wort).	Pevensey.
Calamagrostis lanceolata.	Hurstmonceux.
Peucedanum palustre.	"
Zanthium spinosum.	Kingston.
Leersia Oryzoides.	Amberley.
Lactuca virosa	"

METEOROLOGICAL REPORT.

The most prominent feature of the Meteorological Table printed on the opposite page is the excessively high temperature in the five months, July—November inclusive. In August the mean temperature was $6\cdot1^{\circ}$ higher than the average, and the excess above the average continued until the end of November. In the first half of the present year the temperature did not manifest much variation from the average.

The rainfall in the third quarter of 1899 was very deficient, and again in the months of March—May inclusive in the present year.

Official observations have been taken on behalf of the Brighton Corporation from 1877 onwards. The average annual rainfall for the 23 years, 1877-99, was 29.19 inches. Since 1887, with the exception of two years, there has been, as shown in the following table, a continuous deficiency below this average. In the 11 preceding years, the rainfall in three years only was deficient from the average (viz., 0.27 inches in 1883, 2.83 inches in 1884, and 0.29 inches in 1888).

Derivation from Average Rainfall (29.19 inches) of 23 years, 1877-99.

YEAR.	DEFICIENCY.	EXCESS.	ACCUMULATED DEFICIENCY.
1887	7.07	—	7.07
1888	1.03	—	8.10
1889	1.74	—	9.84
1890	5.58	—	15.42
1891	—	5.19	10.23
1892	2.72	—	12.95
1893	5.06	—	18.01
1894	—	2.76	15.25
1895	4.00	—	19.25
1896	1.35	—	20.60
1897	0.07	—	20.67
1898	8.78	—	29.45
1899	5.72	—	35.17

It is clear, therefore, that we have been passing through an unusually protracted dry cycle of years; and whether we have yet left it behind is uncertain.

ARTHUR NEWSHOLME.

TABLE I.

TEMPERATURE OF AIR DURING MONTH.			WIND.			RAINFALL.			SUNSHINE.		
MONTH.	Highest.	Lowest.	Mean.	N.	N.E.	E.	S.E.	S.	S.W.	N.W.	Calm.
July,	1899	1877-99	65.4	5	1	3	2	-	9	5	3
August,	1899	1877-99	61.8	4	6	12	2	-	1	4	1
September,	1899	1877-99	68.2	3	1	3	5	1	2	3	1
October,	1899	1877-99	62.1	1	3	11	2	2	3	1	1
November,	1899	1877-99	60.1	6	4	1	-	-	10	2	2
December,	1899	1877-99	58.3	5	5	5	1	2	4	3	2
January,	1900	1877-99	53.5	5	5	5	1	2	4	3	1
February,	1900	1877-99	49.2	8	2	-	1	2	2	1	-
March,	1900	1877-99	46.2	5	5	3	2	1	2	1	1
April,	1900	1877-99	41.4	8	11	7	-	1	2	2	1
May,	1900	1877-99	39.2	8	11	7	2	1	2	1	1
June,	1877-91	1877-99	35.0	8	11	7	3	2	1	1	1
Entire Year			32.2	55	55	44	16	21	64	34	34
Average of 1877-99			35.0	20.6	12.0	51.6	50.3	51.6	29.19	64	64
Relative Air Humidity = 100.			65.0	68.4	69.4	60.8	60.4	65.0	65.0	66	66
Saturation = 100.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Relative Air Humidity of Alt.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Number of Days of Sunshine.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Number of Sunless Days.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Number of Hours recorded.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Amount collected in Inches.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66
Number of Days on which Rain fell.			65.0	68.2	69.4	60.8	60.4	65.0	65.0	66	66

Brighton and Hove Natural History and Philosophical Society

TREASURER'S ACCOUNT FOR THE YEAR ENDING 18th JUNE, 1800

Balance in the hands of the Treasurer, 13th June, 1800 £7 3 5

*There is a sum of £100 2*½* per cent. Consols invested in the names of the Hon. Treasurer and Hon. Secretaries, as Trustees for the Society.*

Audited and found correct, 25th September, 1900,

SAMUEL COWELL, } Hon.
J. W. NIAS, } Auditors.

RESOLUTIONS, &c., PASSED AT THE ANNUAL GENERAL MEETING.



After the Reports and Treasurer's Account had been read, it was proposed by Mr. J. P. SLINGSBY ROBERTS, seconded by Mr. PANKHURST, and resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Librarian's Report be received, adopted, and printed for circulation as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“Mr. J. E. Haselwood, Dr. A. Newsholme, Mr. D. E. Caush, Mr. E. J. Petitfourt, B.A., F.C.P., Mr. J. P. Slingsby Roberts, Dr. E. McKellar, Dep. Surg. Genl., J.P., Mr. A. G. Henriques, J.P., and Mr. W. J. Treutler, M.D.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. J. W. Nias and Mr. S. Cowell.”

The Secretary also reported that the following gentlemen who had been elected Chairmen of Sections would, by virtue of their office, be Members of the Council—

“*Botanical Section* : Mr. J. Lewis ; *Microscopical Section* : Mr. D. E. Caush ; and that the following gentlemen who are Secretaries of Sections would also, by virtue of their office, be Members of the Council :—*Botanical Section* : Mr. T. Hilton ; *Microscopical Section* : Mr. W. W. Mitchell.”

It was proposed by Mr. D. E. CAUSH, seconded by Surg. Genl. McKellar, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year :—*President* : Mr. W. C. Wallis ; *Ordinary Members of Council* : Dr. A. H. Dodd, Mr. Harrison, D.M.D., Mr. J. Lewis, F.S.A., C.E., Mr. F. R. Richardson, Dr. R. J. Ryle, Dr. E. Hobhouse ; *Honorary Treasurer* : Mr. E. A. T.

Breed; Honorary Librarian: Mr. H. Davey, Jun.; Honorary Curators: Mr. H. S. Toms and Mr. T. Hilton; Honorary Secretaries: Mr. Edward Alloway Pankhurst, 3, Clifton Road, and Mr. J. Colbatch Clark, 64, Middle Street; Assistant Honorary Secretary: Mr. H. Cane."

It was proposed by Surg. Genl. McKELLAR, seconded by Mr. E. A. T. BREED, and resolved—

"That the sincere thanks of the Society be given to Dr. W. J. Treutler for his attention to the interests of the Society as its President during the past two years."

It was proposed by Mr. S. COWELL, seconded by Mr. SLINGSBY ROBERTS, and resolved—

"That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curator, the Honorary Auditor, and the Honorary Secretaries, for their services during the past year."

On the motion of Mr. PANKHURST, seconded by Mr. BREED, the following alterations of the Rules were made—

Rule 33. "That the words 'at the close of such Meeting' be substituted for the words 'at the opening Meeting of the Session in October' in this rule; and that the following paragraph be added, viz.: 'At the close of the Annual General Meeting in June, the newly elected President shall be introduced to the Meeting, and at the opening Meeting of the following Session he shall deliver his inaugural address.'"

Rule 45. "That the last paragraph be omitted."

The effect of the proposed alterations will be that the President and Office bearers of the Society will enter upon their duties immediately after election instead of as now at the opening Meeting of the Session in October.

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

- British Association, Burlington House, Piccadilly.
- Barrow Naturalists' Field Club.
- Belfast Naturalists' Field Club.
- Belfast Natural History and Philosophical Society.
- Boston Society of Natural Science (Mass., U.S.A.).
- British and American Archaeological Society, Rome.
- Cardiff Naturalists' Society.
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Oct. 29. 1901.

BRIGHTON AND HOVE

Natural History & Philosophical
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ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

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SESSION 1900-1901.

WEDNESDAY, OCTOBER 10TH, 1900.

INAUGURAL ADDRESS

BY

MR. W. CLARKSON WALLIS

(PRESIDENT), ON

“The Amateur in Science.”

I DO not fail to remember, in taking this Presidential Chair, that it has been occupied in former years by Presidents of the Society, some of whom have distinguished themselves in scientific research, and others who, as members of learned professions, keeping in touch with the course and progress of discovery, have been able in their inaugural addresses to present an exhaustive *résumé* of the latest developments of science.

But I assume the honourable office, which by your courtesy has been conferred upon me, not in the capacity of one able in any degree to add to the sum of knowledge as these have done before me; but as representing those who are content, and who have to be content from the circumstances of their lives, or the extent of their abilities, to be simply amateurs in science. I use the word “Amateur” in the sense of one loving the pursuit, but following it without vocation, without fixed purpose, profiting by the labours and researches of others rather than his own. They are—

“ Pickers-up of learning’s crumbs
The not incurious of God’s handiwork ; ”

or to use a word not perhaps euphonious but expressive, smatterers in science.

Whilst the membership roll of the Society embraces many who are well versed in scientific matters, there is, I believe I may say without undue depreciation, a large number who may be thus classed.

Cowper, in a too modest disclaimer of his right to assume the title of poet, describes himself as one—

“ Happy to roam among poetic flowers,
Though poor in skill to rear them.”

I now speak of those to whom, substituting the word *scientific* for

poetic, these lines may well apply ; who find even such happiness in wandering with more or less purpose, sometimes aimlessly perhaps, amid the cultivated domain of intellect, gathering the blooms reared by the husbandmen of the garden, or plucking at will fruit from the Tree of Knowledge.

What then is the place of such in the economy of the Realm of Mind ?

Are they merely drones who take their share of the honey without contributing to the store ?

Not entirely ; for apart from the fact that they take their portion without impoverishing the workers, their position is not altogether a selfish one. For whilst it is the golden rule that the first duty of man as regards his fellow is to endeavour to contribute to his happiness and welfare, there is also a duty of happiness towards oneself, a cultivation of those faculties for enjoyment which all more or less possess, and which as they are developed in the individual go to swell the great volume of happiness in the community.

It will not be necessary here to argue in this connection, the direction in which the highest and noblest pleasure is to be sought, and the purest enjoyment to be obtained. No need to attempt to prove that they are attained to the fullest extent in the appreciation through the intellect, of beauty, order, perfection, obedience to law.

It is these qualities which it is the province of Natural Science to reveal ; and as they are revealed, and the degree to which they are unfolded and appropriated, to that extent are gained some of the most valuable of intellectual advantages,—an inductive habit of thinking, a capacity for judging fairly of facts without which the world is without form and void ; nay more, they produce a refinement and elevation of mind which it is impossible can remain a mere selfish acquisition.

Of the cultivation of the intelligence in such directions a sentence from the Duke of Argyle well applies :—“ It is in seeing the resemblances, and in seeing the correlative differences of things, that all knowledge consists. This perception is the raw material of thought—it is the foundation of all intellectual apprehension.”

So the man of science by patient search and with unremitting toil extracts from the innermost recesses of the treasure-house of Nature a wealth of knowledge which he at once places at the disposal of all who will take it,—to the extent that they can take it,—to their own enrichment.

The ancient sage depicts, in one of the loftiest passages of oriental imagery, a sublime impersonation standing and crying aloud, inviting the uninstructed to share her bounty :—

“ Doth not Wisdom cry,
And understanding put forth her voice ?

In the top of high places by the way,
 Where the paths meet she standeth ;
 Beside the gates, at the entry of the city ;
 At the coming in at the doors she crieth aloud ;
 Unto you, O men, I call.

* * * *

Hear, for I will speak excellent things ;
 And the opening of my lips shall be right things,
 For my mouth shall utter truth,
 Hear instruction, and be wise.
 Happy is the man that heareth me,
 Watching daily at my gates,
 Waiting at the posts of my doors."

Such is the attitude of the genius of Science, offering with unstinted liberality, one may say with prodigality, the wealth of her wisdom to all who can appreciate its worth, and will accept it at her hands.

In the domain of social economy, the disposal of commodities of various kinds requires the co-operation of the producer, the distributor, and the consumer.

Without pressing the analogy too far, we find in the domain of science a similar co-operation existing, by which the laws and forces of Nature, the marvels of matter and of inorganic life, become revealed, interpreted, and enjoyed. There is the discoverer who, by systematic investigation, enunciates the great principles of natural science ; there is the inventor who applies them mechanically for the necessities and utilities of life ; and the lay individual,—our amateur, if you will,—to whom the knowledge and facts which are placed before him come as a contribution to his intellectual enjoyment, and an addition to the pleasure of his existence.

It is clear that the amateur will not advance the cause of science along the lines either of the discoverer or the inventor. The cause of science is advanced by the man of "one idea at one time." It is true there have been and are some few giants whose vast genius enables them to range unchallenged in every department ; such are Darwin, Tyndall, Huxley, and others. But, generally speaking, the workers who leave their mark and materially add to the sum of knowledge are those who centre their investigations within certain limits, and often very narrow ones. They are, in fact, specialists, who devote years to the elucidation of a single problem, or in finding out all that can be known concerning a single species of plant or animal.

And, in the end, though their life-work, as far as science is concerned, may be included in a single monograph, it is to that extent a solid and indispensable gain, and knowledge on the subject has been advanced by a distinct stage which will not have to be traversed again.

But the end of science is not the miserly accumulation of

facts, stored in books, like a talent hid in a napkin. Applied to the circumstances of life, science becomes the most potent of all intellectual factors in promoting the wealth, comfort, and happiness of humanity. So universal are its applications that we are apt to forget how much we owe to science, because so many of its wonderful gifts have become familiar parts of our everyday life, and their very value makes us forget their origin.

The infinite variety of methods of locomotion and communication ; the aids to the manufacture of every detail of food, clothing ; the furniture of houses ; the development of arts and commerce ; the preservation of health and the eradication of disease ; the production of means for pleasure, recreation, education, and ten thousand other things, are the direct results of scientific invention and discovery. If we take up the most unconsidered trifle and trace its history, we shall be led back to some scientific basis, the discovery of which was in itself a triumph.

There is not a force in nature, nor scarcely a material substance which we can employ which has not been the subject of numerous original experimental researches, many of which have resulted, in a greater or less degree, in opening up fresh fields for employment and commercial activity. Therefore, says Archdeacon Farrar, "in the achievements of Science there is not only beauty and wonder, but also beneficence and power. It is not only that she has revealed to us infinite space crowded with unnumbered worlds ; infinite time peopled by unnumbered existences ; infinite organisms, hitherto invisible, but full of delicate and iridescent loveliness ; but also that she has been, as a great Archangel of Mercy, devoting herself to the service of man. She has laboured, her votaries have laboured, not to increase the power of despots or add to the magnificence of courts, but to extend human happiness, to economise human effort, to extinguish human pain.

* * * *

On these and all other grounds I think (continues Farrar) that none of our sons should grow up wholly ignorant of studies which at once train the reason and fire the imagination, which fashion as well as forge, which can feed as well as fill the mind."

From the consideration of the highest and noblest missions of science, which have transformed the social and commercial conditions of the life of the world, our thoughts are thus turned to its effect upon the bulk of mankind as a means for opening the mental eye to see and to ear to hear. Without its continual aid, the individual mind, as well as the mind of the community, would relapse into a condition of confused superstition, "in wandering mazes lost."

The ordinary mind, untrained in science, is, to a great extent, the mind of a child. The child's mind is filled with

wonder at all that dawns upon it ; imagination takes the place of certainty of knowledge, and fills the unknown with mental creations. Poetry occupies the place of prosaic fact, for poetical expression is the natural language of emotion, and there is nothing that excites the emotions of the mind as do the beautiful and awe-inspiring works of Nature.

Said a little fairy four-year-old to me the other day, pointing to a radiant cloud, " Is that where the sunshine lives ? " A story is told of a little negro girl who thought that " the stars were gimblet holes in the floor of heaven to let the glory through." Natural, spontaneous poetry this ; not perhaps of the exquisite finish of Shakespeare's :—

" Look how the floor of heaven
Is thick inlaid with patines of bright gold ; "

but nevertheless equally the language of the emotion of the mind.

The child to-day imagines the copse at the bounds of the home-garden to be inhabited by wood-sprites ; and the field half-a-mile away to be peopled by fairies and elves, and a cave is always an abode of awful mystery.

A fuller knowledge, when it comes, will disillusionize the child, will dispel the childish fantasy and replace it with solid fact, and, perhaps,—not a little disappointment.

What the child is, such are nations in their infancy ; and, like the child, they have their growth in knowledge and their disillusioning. Pascal in his "Pensées" says :—" The whole human race in its development through a long series of ages must be regarded but as a man who lives perpetually and learns continually."

In the beginnings of nations, the forces and aspects of Nature so little understood, or rather so much misunderstood, offered nothing but a field for imagination. Peering into the unknown they peopled the world with fancy ; phenomena for which the undeveloped mind could offer no natural explanation, were regarded as the outcome of occult agencies or the handiwork of superhuman beings. Their superstitions had as a root a belief in Animism by which the savage saw life in every object, animate or inanimate as the child sees life in the doll with which it plays. Animals, and even stocks and stones, were supposed to have souls, and why should they not have some mysterious power of helping or of hurting him ? And thus the idea gradually grew of the advisability of propitiating the unseen by worship and sacrifice.

" From such rude beginnings we see nations as they advance in civilization rising to higher conceptions, developing the ghosts into gods and confining their operations to the greater phenomena of Nature, such as the sky, the earth, the sea, the sun, the stars, storms, thunder, and the like. And by degrees the unity of

Nature begins to be felt by higher minds, priestly castes are established who have leisure for meditation ; ideas are transmitted from generation to generation ; and the vague and primitive Nature worship passes into the phase of philosophical and scientific religion."

Science thus pushes farther and farther back the limit of the mysterious and reduces to commonplace truth the poetic vagueness of mythic lore.

To the ancient Greek the travellers' tales, brought back by early explorers from the bounds of the known world, contained descriptions of natural marvels (exaggerated, no doubt), for the explanation of which nothing would suffice but the intervention of a god or a demigod. Wonders but half seen, or but heard of by report, were woven into legends which were well-believed ; but they are instances which show that, where no solid understanding of fact existed, there was the region for poetic fancy, or fancy which from its natural origin took a poetic form. And so the imposing rock masses at the entrance of the Mediterranean, in description at any rate, seemed like the pillars of a gateway, which none but Hercules could have fashioned.

Nor is it difficult, as another instance, to trace the origin of the notion of the Centaur. Commencing with the fact of the national custom or sport of bull-hunting in Thessaly, the expert horsemen who engaged in it evidently made a somewhat similar impression upon their neighbours as did the Spaniards upon the Mexicans who believed the horse and man to be one creature. Or at any rate as the story of the prowess of the Thessalian mountaineers came as a hearsay marvel to an imaginative people, the Centaur monster would be easily evolved. The adventures of Ulysses also abound with instances where natural phenomena evidently gave rise to mythical ideas.

Northern Europe, with its dull and cloudy skies, strangely impressive to the denizen of the sunlit south, became pictured to imagination as a region where Helios never revealed himself, and the phrase "Cimmerian darkness" still remains to testify of the myth. Again, the awful mystery connected with a volcano would, with the greatest naturalness, be connected with plutonic operations ; and that Etna should be regarded as the home and forge of Vulcan is easily understood.

Nor need we go back to primeval or classic times to discover the tendency of the mind to allow the imagination to run riot where it is not held in check by the rigid regulation of Science. Medievalism, of course, abounds with instances, in fact, the very life of that time was saturated with superstition and speculation. There is something particularly *naïve* in the manner in which ancient maps pourtray the regions beyond the limits then actually known, and in the impossible monsters, human and bestial, which figure, in all seriousness, in books of natural history.

Flint implements and celts were then regarded as thunder-

bolts which had fallen from the sky, or were even the bolts by which Satan and his angels had been driven into the abyss. This thunderbolt theory is common to many countries, nor is it extinct in our land even to-day; where masses of iron pyrites and fossil belemnites are very ordinarily supposed to be genuine thunderbolts. I cannot resist quoting a particularly choice specimen of "thunderbolt" lore, which is recorded in Tylor's "Early History of Mankind," and referred to by Laing. One Tollius, in 1649, thus describes some figures of stone axes and hammers:—"The naturalists say they are generated in the sky by a fulgurous exhalation conglobed in a cloud by the circumfused humour, and are, as it were, baked hard by intense heat, and the weapon becomes pointed by the damp mixed with it flying from the dry part, and leaving the other end denser, but the exhalations press it so hard that it breaks out through the cloud and makes thunder and lightning."

This seems to be a specimen of science as it was taught, or, at any rate, learned in England 250 years ago. The innate love of the marvellous fostered such speculations and superstitions,—and yet, through it all, there was a feeling after truth. And as, piece by piece, the truth is arrived at, and Science lays the firm foundation upon which the fabric of increased knowledge shall rise, ancient systems are destroyed, impossible figments of imagination are dispelled, old ideas change, and sober thought and rational proof take their place.

"The old order changeth, yielding place to new."

The process of being disillusioned is, however, not always an agreeable one. It is not always an easy thing to divest oneself of notions and beliefs which have been a part of one's very nature. Pioneers in Science in all ages have found this to their cost in their efforts to replace the false with the true, and Galileo and Roger Bacon in their prisons, and Giordano Bruno at the stake, were martyrs to their testimony for the truth.

Besides, there is something of a sense of humiliation in having to renounce opinions which have been held as verities, from which there was no appeal.

Imagination, too, has its roseate hues; and its vague possibilities have a real and definite charm which it is hard to relinquish. But Science is inexorable, and, to the open mind, the most cherished preconceptions have to fall before invincible truth.

But whilst Science is thus *destructive* towards that which is founded on error, she is *constructive* concerning that which is true, and not only so, but whilst she uproots the source of a pleasure that is merely poetic, sensuous, aesthetic in its relation to Natural Science, she implants a pleasure which is intellectual, and a capacity for appreciating the beauty and order of Nature;

and after all the real causes of natural phenomena are far more striking and contain more real poetry than those which have occurred to the untrained imagination of mankind.

These remarks show that true science having replaced unsystematic speculation with a solid basis of fact, whether in the mind of a child, the uninstructed national mind, or the individual mind, there is established a means for the opening out of every mental faculty.

This, then, is the position of the Amateur; and as the principles of Natural Science become apprehended, it is like the uplifting of a veil, by which the whole being is quickened as it perceives, in however small a measure, the order, law, and beauty in Nature, and in beholding, becomes a lover of them.

Whilst, therefore, the awakened mind of the amateur may not *discover* in the sense of adding to the aggregate of human knowledge, yet the habits of observation being stimulated, enable him to make research on his own account and for his own benefit.

Though he enters into an inheritance of garnered knowledge his own efforts will add to its value to himself by compound interest.

"Science," said a Royal Commission in 1861, "quickenes and cultivates directly the faculty of observation, which in very many persons lies almost dormant through life, the power of accurate and rapid generalisation and the mental habit of method and arrangement; it accustoms young persons to trace the sequence of cause and effect; it familiarizes them with a kind of reasoning which interests them and which they can promptly comprehend; and it is perhaps the best corrective for that indolence which is the vice of half-awakened minds, and which shrinks from any exertion that is not, like an effort of memory, merely mechanical."

So much has the value of science become recognized in these respects, that, as we all know, of late years science has been an accepted part of the curriculum of schools of all grades, and received every encouragement possible from the government. To the rising generation education in Natural Science is therefore not so much a luxury as a school task.

At least it must be so if the teaching of it is simply a "subject" in the technical sense of the Education Code. It is not in this way that naturalists are made. It is not so much a matter of *knowing* as of *loving*, and the charms of Nature are not to be found by simply regarding her as one might a beautiful creation in marble, but as a companion, instinct with the breath of life. When, therefore, the youth leaves his school it must be borne in mind that his education is but begun, and it is then that societies, clubs, or other means to encourage him to continue his studies, not so much in a theoretical way as in an experimental, will be of great assistance to

him. Because, although not one in ten thousand may develop into a man of science as a profession, the inestimable advantages of some training in Natural Science which we have alluded to, will be worth having. He may, at any rate, develop into an amateur of science and a lover of Nature to his own profit and pleasure and to others as well.

If I may be permitted an allusion to my own personal experience, I should like to recall my own schooldays. At that time it was somewhat unusual to introduce the study of Natural History otherwise than in a strictly scientific manner, but with us every encouragement was given to engage in Natural History pursuits in the most practical ways. The effect has been very noticeable, for although it may be that but very few of my old schoolfellows have attained to anything like distinction, yet to the majority the habits of observation then gained, together with the actual knowledge acquired, have been of incalculable benefit in after years.

I do not propose to offer any challenge to advocates of athletics, but I have still a vivid recollection of the delights of those Saturday afternoon rambles, the popularity of which was testified to by a depleted football or cricket field.

In charge of a senior boy, little groups would start off at the earliest moment, well provided with shell scoops, butterfly nets, plant tins, and other naturalists' *impedimenta* (to say nothing of exuberant enthusiasm), bound for the various happy hunting grounds within a radius of five miles or more. O, what treasures did that muddy ditch or stagnant pool yield, in the shape of aquatic coleoptera; what entomological rarities that treacled tree; what a botanical Eden was Askham Bog!

Then came the excitement of the return home and the discharge of the various spoils in the class-room specially set apart for the purposes of the arrangement and the preservation of specimens. The strange and mingled odour of that place still abides as a vivid memory, and when one day, after all these years, I encountered a similar complex effluvium, by association the joys of those schoolboy explorations again came vividly before my mind. Nor was it only in collecting that the interest of these boys was manifested; but I remember the diaries of observations which were compiled, and the exhibition at the end of the term, where the specimens, duly arranged and described, were displayed in a manner educational in a high degree.

In after years for most of us engaged in commercial or professional life the opportunities for pursuing Natural History have become very limited, and one's reading in these lines, discursive and unsystematic,—somewhat of the "Science Siftings" type,—but with this groundwork laid, it is still possible to keep in touch with the progress of Science and to feel a sympathetic thrill at each advance which is made.

What fascination even a smattering in Geology has ! Geology is a branch of science, which above all others, perhaps, lends itself as a suitable pursuit to the amateur. Independent of seasons, capable of being studied in any locality, and though not necessarily requiring much knowledge in other branches, at any rate at first, yet with affinities in almost every other branch of science,—biology, botany, chemistry, mathematics, and the like. With such information as may be readily picked up, the railway cutting, the quarry, the hillside, the shore, every scarp and bank becomes instinct with meaning.

In early manhood it was my lot to live for a time on the coast of Durham. Much of the landscape is bare and uninteresting, marred by the gaunt machinery of the coalpits, from which extend the long, hideous banks of shale and spoil from the mines, stretching into the fields like lava streams from the crater of a volcano. But to this day I cannot recall to mind, without the revival of the feeling of keen pleasure, the leisure hours spent in exploring the geologic wonders of that region. It was a great occasion when first I discovered (new to me, of course,) the boulder clay glacial deposit on the coast, the remains of the great ice-sheet, which streamed from the Cumberland mountains and the hills of upper Teesdale, and ground its way into the bed of the North Sea, where it met the vast glaciers of Scandinavia. How precious were the beautifully scratched and polished boulders of carboniferous limestone, of granite, or of other rocks, which I found embedded in the mass, and which told such a marvellous story of the movements of the overwhelming mass of arctic ice ! And another day a wonderful raised beach of seaworn shingle and sand cemented into hard conglomerate came to light ; and then there were long afternoons on the shale banks amongst the fossils of the coal measures, or spent in examining the magnesian limestone, with its comparatively insignificant fossils, but which on acquaintance grew to be so interesting.

It is far from in an egotistical spirit that I refer to these experiences, but I present them as typical of what the pleasures of a mere scientific amateur may be. Others find equal charm in botany, of which I know nothing, and yet here may I give an example of the interest which only a very slight observation may give.

It is well-known that one of the botanic specialities of the County of Sussex is the somewhat insignificant *Trifolium Stellatum*. I had seen a single specimen, carefully preserved, from the shingle bank at Shoreham, the sole habitat in Britain of this plant, and where its seed is suspected of having been brought in ships' ballast. But when in Sicily this year I found it growing in profusion, there seemed a special interest to be attached to it.

It is, therefore, surprising how a comparatively small degree of knowledge gives an insight by which Nature is

transformed and beautified, not, of course, objectively, but subjectively. It is an *e-ducation* in the sense of the derivation of the word, that is in the sense of *leading out* the faculties to perceive and observe.

A lesson or two in the art of mixing colour on the palette will give a wonderful appreciation of hue in Nature and in Art, and in like manner a few well-directed hints of a scientific man give to the less instructed a line of direction in which he may pursue his own researches with much profit.

So the lecture to which we listened a few months ago by Mr. Enoch has invested the aphides of my garden with a romantic interest which my gardener scarcely appreciates.

With such education in Natural History a charm is given to a country walk which is indescribable. Sit on a hillside or a wayside bank, and peer into the mazes of grass and herb, and you are translated into another world, teeming with life into the concerns of which you seem to be able in measure to enter. The vagaries of a single ant will keep your attention occupied for half-an-hour, especially if you have had an introduction to the manners and customs of his kind through Lubbock's book. Then a bee appears upon the scene, and a fresh line of thought is started, or a spider commences his web-building operations and again diverts your admiration.

So much of real pleasure can be thus experienced by simple observation, that one hesitates to refer to specimen collecting which, after all, if not systematically done is of very doubtful advantage. To most of us amateurs the days of collecting are past, though probably with us all there has been a phase of our experience when we were possessed with a passionate desire to collect everything that pleased us. It was with something of the motive, and had something, too, of the melancholy result, which is said to have prompted the Afridis when they killed a descendant of the Prophet in order that they might worship at his tomb. But of course a collection without system and proper classification and nomenclature becomes simply a mass of mere rubbish, which it is a sorrow to possess. And after all, with good museums so accessible, there seems but little need to attempt to collect such objects as may better be seen in them. And to the naturalist, however limited his studies, the museum ceases to be a "valley of dry bones," for he finds that when Science prophesies, as in the vision of old, these dry bones can live.

But I feel I must not further weary you in pursuing the subject of the endless vistas which open up to seeking minds in the region of scientific investigation. Very much might be said as to what foreign travel presents to such, not simply as a matter of "tours" and "trips," but as veritable explorations and voyages of discovery, but time will not allow.

Thus the true lover of Nature need never be dull, because for him there is always at hand a feast satisfying alike to the

mind and to the eye, with the further gratifying knowledge that, however much he takes for himself, there is always as much for everyone else. This brings about a kind of freemasonry amongst all who are like-minded, and this fact alone opens up further means for enjoyment.

There is the charm of congenial conversation, the interchange of ideas and the gratification of finding points of contact with others in mutual interests. And perhaps not the least is found in the imparting of what knowledge one may have to those who have less, and in feeling that one is kindling fresh interests in another mind.

May I, therefore, lay before the members to-night my sincere conviction that one of the most important functions of our Natural History Society is here indicated, and that the inclusion in its ranks of a goodly band of Amateurs in Science is its glory, and one of its most valuable and beneficent operations.

It is vain to suppose that, save for a few exceptions, that they can, by original research, add materially to the accumulated total of knowledge, or that they can come into competition with the professor on his own ground. In science, as well as in art, the rate of progress is becoming more and more rapid in an increasing ratio, so that the simple amateur is left hopelessly in the rear. It is not for him to lead but to follow, and, under superior guidance and with sympathetic help, it is his joy so to do.

This consideration should not have a depressing influence upon the efforts of the amateur, although, in all his conclusions he may find himself forestalled. I can conceive the possibility of one having, with great labour, compiled a series of observations, offering the result in the shape of a paper to our Secretary, and receiving, in reply, a courteous inquiry if he were aware that the subject had already been exhaustively dealt with in a monograph by Professor Bumsterhausen, and that, after him, there was no more to be said.

But, from all we have seen, it is clear that it is not in these directions that the amateur finds his reward. Pope has said that "a little learning is a dangerous thing," which may be truth if the "little" should lead to presumptuous conceit; but, on the other hand, with diligence and humility, the "little" is of infinite value, for it is a solid basis on which to build more, and it is a practical truth that "to him that hath shall be given."

Nature has her high priests, but she has also her hosts of humble worshippers. And Nature becomes to her votaries, not a tyrannical goddess, but a kind and loving friend, with whom communion is a precious and lasting privilege; and as the years pass away her teachings become increasingly a present delight, and fill the mind with a store of happy memories.

TUESDAY, NOVEMBER 18TH, 1900.

The Ancient Beaches of Brighton and their Microscopical Contents,

BY

MR. FRED. CHAPMAN, A.L.S., F.R.M.S.

RAISED Beaches are among the most interesting phenomena with which the geologist has to deal. That they have been subjected to elevation above the present sea-level is clear from their relative position to modern sea-beaches, to which they are similar in structure; often consisting of shingle or subangular and rounded fragments of rock, which have been rolled and worn down by the tides, and accumulated in a bank above mean tide by the superior forces of spring tides and rough weather.

In a bay of considerable extent we may find at one end the piled-up shingle due to concentration of wave action against a steep shore; and at the other, where the shore has a gentler slope, finer material rapidly passing into fine sand which is often ripple-marked, owing to the currents abating in force. A section through a bed of this fine sand will sometimes show false-bedding, and sometimes horizontal stratification. We also find the conditions of a fine sandy area indicating deeper water.

The ancient sea-beach to be seen at Brighton, east and west of the town, was first brought under notice by Dr. Mantell, who described the sections seen in the cliff near Kemp Town (see "Fossils of the South Downs" and "Medals of Creation"). The extension of this ancient beach to Shoreham and Worthiug was recorded by Frederick Dixon, whilst Godwin Austin described a similar beach between Bognor and Bracklesham. A section taken along a line from the shore at Brighton to the chalk downs will show the Raised Beach forming a level platform or terrace until it ends against the foot of the chalk hills. This beach is in turn covered by a rather irregular layer of rubble-drift deposit. The hall in which we are now assembled is actually situated upon the Raised Beach.

Standing on the shore at Black Rock we can see the bed of rounded shingle pebbles with gigantic sarsen stones at the base,

resting upon the foundation of chalk, and following this to the east we find the old beach suddenly ends against the ancient sea-cliff which here nearly turns at right angles to the present cliff. At Black Rock there is an interesting occurrence of a fallen mass of chalk in the old beach. Tracing the old beach to the west of Brighton, through Hove to Portslade, the level gradually widens and the old sea-cliff recedes, until at Aldrington and Old Portslade the chalk cliff is a mile or so inland.

The recent excavations by the shore at Aldrington, where sand pits have been opened in the Raised Beach, have given geologists a good opportunity for examining these beds in detail.

By comparing these cliff exposures on the east and west of Brighton we can see that they are situated in different parts of the same bay, for at Aldrington the Raised Beach consists of 16ft of sand followed by about 6in. of pebbles; whilst at Black Rock we have only a few inches of sand, but about 10ft. of large boulders and rounded pebbles. Aldrington, in fact, stands on that part of the bay which at the time of the formation of the Raised Beach was a mile or so from the shore-line. This is further proved by the section at the brick pit near Portslade Station, where there is very little sand and 3ft. of beach pebbles.

In the sand bed at Aldrington marine shells are very common, chiefly the obtuse periwinkle (*Littorina obtusata*) and the mussel (*Mytilus edulis*). Both of these are found in shallow water, and prefer areas between high and low tides. The mussel shells are extremely fragile. In this case it appears to be due to the following cause. The shell consists of an inner nacreous and an outer fibrous layer. The nacreous portion which was of aragonite, has changed over into the stable condition of calcite, and in the process rough cleavage cracks were developed which has tended to make the shell rotten. A large subangular flint with many barnacles attached was found in the sand at this locality.

The white sand contains innumerable microzoa. Of the Ostracoda, the little bivalved Crustaceans, the species which lived during the accumulation of the sand of the Raised Beach are those which we find near the shore at the present day, with the exception of two forms which are more northern in their habitat. Six species of the genus *Cythere* were found here.

The carapaces of eight species of Ostracoda, which are known to live only in streams, ponds, and marshes, were found introduced into the sand of the Raised Beach, by fluvial or even æolian agency.

A derived fossil microzoic fauna is also present, which is made up as follows:—

Two species of Wealden Ostracoda, which were probably introduced into the Raised Beach by a river draining the Weald, as the river Adur.

Seven species of Gault and Chalk Ostracoda, probably derived from the adjacent cretaceous beds.

Also a single specimen of a Tertiary Ostracoda was found in the sand of the Raised Beach, probably derived from an outlier of Lower Tertiary clays which at that period would be found resting on the chalk of the neighbourhood.

The contemporaneous Foraminifera, of which I found eight species, belong to the genera *Gaudryina*, *Truncatulina*, *Pulvinulina*, *Rotalia*, *Nonionina* and *Polystomella*.

There were also many derived chalk Foraminifera in the sand of this spot.

Throughout this sand bed are irregular seams of concretionary sandstone. These concretions vary from the most grotesque shapes to tabular layers. They were formed by percolating water charged with carbonate of lime, depositing calcareous matter around each granule of sand presumably as aragonite, which afterwards passed into the form of calcite. The sandstone does not derive all its calcite cement from the shells, for the latter are often found adherent to concretions, but certainly much of it has been derived in this way. When a piece of this sandstone is treated with hydrochloric acid, the residuum obtained is a fine sand exactly like the sand of the bed in which the concretions are found; it is composed of quartz and flint with an occasional sponge spicule derived from the chalk.

The top of the Raised Beach, at Aldrington, consists of a layer of well-rounded pebbles or small boulders resting on fine brown clay, in which are embedded the shells of mussels, &c. This clay, when washed, yielded a fine sand containing a large proportion of the heavier minerals, as zircons, rutile, tourmaline, kyanite and garnet. Some of the zircons are well crystallised, and show inclusions and gas cavities in the interior. All the microzoa found in this seam are indigenous to the deposit. A species of *Cythere*, one of the Ostracoda, and fifteen species of Foraminifera were also found in this brown clay.

There seems to be some evidence of intermittent ice action in these deposits. For instance, in places, the top of the sand beds show a wavy surface exactly like the trail of till and brick earth, and possibly indicates the stranding and melting of ice.

We scarcely have time here to discuss in detail the various theories of the elevation of beaches. The followers of Sir Charles Lyell maintain that the raised Beaches are evidence of the slow and steady movement of great land masses which form part of the gigantic folds seen in the formation of mountain chains. On the other hand, Professor Edward Suess has pointed out some serious drawbacks to the universal application of the theory of land elevation. One of these is the fact that Raised Beaches are often seen to overlie strata of very different hardness and struc-

ture, varying from soft clays to the hardest rocks. Since the ancient beaches are as a rule wonderfully horizontal in their present position, it seems hardly conceivable that land masses of such different structure could be so uniformly upraised. Suess believes that in many cases the level of the water has been lowered by earth movement or wrinkles affecting the ocean basins. A kernel of truth probably exists in both views, and the raising of the land and the lowering of the water level may at different periods have produced the same results.

We may see by a glance at a map showing the Raised Beaches of the south of England, that they are almost invariably situated on a foundation of some hard rock. Those which rested upon soft rocks have been cut back and entirely lost, the hard foundation of the others being their safeguard. We have already seen that at Brighton the Raised Beach rests upon Chalk. At Weymouth it has a foundation of Portland Limestone. The Raised Beach at Saunton, in Devon, is worth a few passing remarks. It is there found resting on the upturned edges of Upper Devonian Slates. At the base of the ancient beach, on the old waveworn surface of the slates, there are here and there along this part of the coast enormous boulders of granite. A picture of one of these is here shown which probably weighs about seventeen tons, and must have been carried by an iceberg to its present position. Above this Raised Beach there is an interesting deposit of false-bedded sands, rendered coherent by calcareous material, with included marine and land shells. This accumulation is of great thickness, often measuring 50ft., and representing ancient sand-dunes formed above high water mark, much in the same way that Braunton Burrows are now being formed. At Torquay and Baggy Point the Raised Beach is found again upon Upper Devonian Rocks. At Weston-super-Mare and at Gower, in South Wales, it is found on the Carboniferous Limestone.

In conclusion we may note the many coastal areas affected by recent upheaval or the reverse, in various parts of the world, and for a case lately brought before our notice this may be illustrated by the views taken by Mr. C. W. Andrews, of the elevated beaches and reefs of Christmas Island.

The Lecture was fully illustrated with a large number of Lantern Slides.

WEDNESDAY, DECEMBER 12TH, 1900.

An Evening for the Exhibition of
Specimens & for Microscopes.

FRIDAY, JANUARY 25TH, 1901.

Among the Books:

BEING NOTICES OF THE MORE IMPORTANT WORKS IN THE
COLLECTION PRESENTED TO THE SOCIETY BY
Mr. J. E. HASELWOOD.

MR. HENRY DAVEY, JUN.

WEDNESDAY, FEBRUARY 13TH, 1901.

How Electricity is Measured,
With Experimental Illustrations.

MR. E. PAYNE, M.A.

TUESDAY, FEBRUARY 26TH, 1901.

Autocrats and Fairies.

MR. FRED ENOCK.

WEDNESDAY, MARCH 13TH, 1901.

The Pottery of Prehistoric and Roman Britain,

BY

MR. H. S. TOMS

(*Acting Curator, Brighton Museum*).

THE earliest chapters in the history of the potter's art in our country lie hidden in the obscurity of pre-historic times; and, as to the origin or introduction of this art into Great Britain, the evidence afforded is much too fragmentary to enable one to form any valid conclusion.

The first traces of the pre-historic potter consist of the few fragments of rude hand-made pottery occasionally found in the Long Barrows, or burial mounds, constructed by man during the Neolithic or latest period of the Stone Age.

STONE AGE POTTERY.—Of the pottery of the Stone Age but little is known owing to its extreme rarity. As far as I am able to ascertain, not a vestige of it has been discovered during the investigations of their flint mines and entrenchments. It seems solely confined to the burial mounds; in them it but infrequently occurs, and then, invariably, in a fragmentary condition. In the majority of instances, moreover, its position in the barrows leads to the supposition that its occurrence there is purely fortuitous, it being generally found either in the body of the barrow away from the primary interment or at the bottom of the ditch surrounding the barrow. These fragments, in all probability, constitute the remnants of the easily broken domestic vessels of the persons employed in the construction of the mound. The custom of burying pottery in any shape or form with the dead does not seem to have existed. Only one instance is known of a vessel being found in a fragmentary condition with the primary interment. This was discovered by Dr. Thurnam in a long barrow at Norton Bavant, Wilts. It is figured in vol. 42 of the "Archæologia," p. 194, from which I have made the full-size sketch I now exhibit.

Like all pottery of this period, it is hand-made, the paste containing small fragments of pounded shells. This latter ingredient and the method of manufacture are the principal characteristics of the Stone Age pottery.

Owing to its extreme rarity, but few museums are the fortunate possessors of these fragmentary relics of the Neolithic potter's art. However, through the kindness of a great friend, I am enabled to lay before you two pieces of this interesting ware. They were found with others lying underneath the previously undisturbed chalk silting on the bottom of the ditch of a long barrow on Handley Down, Dorset. Another fragment identical in quality to these was found near the primary interment ; and, judging by the results of very critical tests afterwards applied by General Pitt Rivers to ascertain the rate of the disintegration of the sides of the ditch and the consequent accumulation of silting at the bottom, there seems no question as to their being of the same age as the barrow itself. Furthermore, I can personally vouch for their authenticity, as it was my good fortune to conduct the excavation of the barrow in question, and to be present during the whole time that the work was in progress.

METHOD OF MANUFACTURE.—In the endeavour to unravel the knotty problems which beset the scientist in his study of the arts and customs of prehistoric races, he has frequently found the elucidation of many obscure points by turning his attention to the study of savage life, and of the peoples who retain in their habits and arts the survivals from primitive ancestors. The value of this comparative study is well exemplified in the case of stone implements ; and it may not be inopportune to adopt the same plan in dealing with the probable methods employed by the Stone Age race in the manufacture of their pottery. This will also form an excellent preliminary to our consideration of the pottery of the succeeding period—the Bronze Age.

The material illustrations of hand-made pottery which I have selected from the museum collections for this purpose, are two Hebridean "craggans," and a pot made by West African savages in the Hinterland of Sierra Leone. The two former were actually used as late as 1896 by the inhabitants of the Hebrides. They were presented to the Museum by Mr. A. F. Griffith, and were obtained from crofts or huts near Barvas in the Isle of Lewis, N.B. Until thirty years ago there was little communication between these islands and the mainland ; and, in their daily life, the inhabitants retained habits which were of the most barbaric simplicity. Time does not admit of anything like a description of this interesting people, so I must restrict myself to the consideration of their pottery.

It appears that the making of this class of pottery fell to the lot of the Hebridean women. The process of manufacture has been so well described by Dr. Sir Arthur Mitchell, that I cannot

refrain from quoting it at length. Whilst at Barvas in 1863, he engaged a woman to show him the whole process. He writes :—

" The clay she used underwent no careful or special preparation. She chose the best she could get, and picked out of it the sand and fine gravel which it contained. With her hands alone she gave to the clay its desired shape. She had no aid from anything of the nature of a potter's wheel. In making the smaller 'craggans' with narrow necks, she used a stick with a curve on it to give form to the inside. All that her fingers could reach was done with them. Having shaped the 'craggan,' she let it stand for a day or two to dry, then took it to the centre of the floor of her hut, filled it with burning peats, and built peats all round it. When sufficiently baked, she withdrew it from the fire, emptied the ashes out, and then poured slowly into it and over it about a pint of milk in order to make it less porous. The 'craggan' was then ready for use and sale.

" It is desirable at once to realise, with regard to these 'craggans,' that there is nothing in the way of pottery more rude. They are made of coarse clay containing sand and gravel; they are not baked in an oven, but in an open fireplace; they are shaped with the hands without aid from any sort of potter's wheel; they are unglazed, they are globular and without pediment; they are nearly always destitute of ornament, and such ornamentation as does occasionally occur on them is composed of straight lines made with a pointed stick or the thumb nail, or with a piece of cord. The rudest pottery ever discovered among the remains of the Stone Age is not ruder than this, and no savages now in the world are known to make pottery of a coarser character." ("The Past in the Present," p. 25-28.)

The other specimen to which I wish to draw your attention, was made in Mendiland, Sierra Leone, and was purchased together with a fine ethnographical collection from this district by the Corporation from Mr. T. J. Alldridge. In writing of his wanderings in the country of the Mendis, Mr. Alldridge states "pottery making is the great industry of the women, and very clever they are at it. With only a lump of clay from a neighbouring stream, a board, and a couple of cane modelling sticks, in a few minutes a woman will turn out for you a large and well-formed bowl." ("Wanderings in the Hinterland of Sierra Leone," "Geographical Journal," August, 1894, Vol. 4, No. 2, p. 139.) He does not mention how the pottery is baked. In the paste of this pot a large admixture of mica may be observed. Mr. Alldridge informs me that this was not intentionally introduced, but that mica forms a marked constituent of the greater part of the clays used by the Mendis in making their pots.

Many other different methods employed by savages in fabricating their hand-made pottery could be quoted; but the two examples just given are sufficient for my present purpose. Com-

paring these specimens with the sketch of the pot found by Dr. Thurnam and with the two fragments of Stone Age pottery, I think we may reasonably conclude the Neolithic potter must have given these productions a somewhat analogous if not a similar treatment in making them.

THE BRONZE AGE.—We now pass on to the time of the substitution of bronze tools for those of stone. Bronze tools appear to have been fabricated on the Continent long before the use of this metal was known in Britain ; and its introduction to this country was due to the conquest of the Neolithic Iberians by the continental Celtic tribes among whom it was in common use. We have, also, ample proof afforded by archaeological research that the transition from the use of stone tools to those of bronze was gradual, and that the Stone and Bronze Ages considerably overlapped each other.

The principal remains of Bronze Age man which exist at the present day are his burial mounds, his fortified camps, and the remnants of the pile-dwellings which he erected in lakes and morasses. The barrows or burial mounds, which are abundant, have received most attention from archaeologists ; and the study of the remains associated with the interments has shown the Bronze Age capable of being divided into an early and a late stage. The first was the transitional or overlapping period, when the stone tools were being superseded by wedge-shaped bronze axes originally modelled from a prototype in stone, and by bronze daggers. By far the greater number of the Bronze Age tumuli or barrows in this country belong to this early stage. The latter division is marked by the presence of swords, palstaves, socketed celts, and elaborate bronze ornaments.

POTTERY.—The pottery of the Bronze Age is of great interest. Our Museum possesses but three poor specimens, and I shall, for want of better illustrations, have to treat this period in a somewhat cursory manner. The majority of the best examples have been found associated with the interments in the burial mounds, and all specimens hitherto discovered are of the hand-made type. From negative evidence we may therefore assume that the use of the potter's wheel was unknown to the Early Bronze Age Briton.

When considering the Stone Age we saw that inhumation was the chief mode of burial. In the Bronze Age, however, the prevailing custom was cremation, though burial by inhumation still obtained, such interments being by no means rare, and the bodies having been buried in a crouched or contracted posture as is the custom among so many savage races of to-day.

CINERARY URNS.—After the dead body had been consumed on the funeral pile, its ashes were carefully collected and placed in a special pot which we now term a cinerary urn ; a grave was then made just large enough to contain the urn, generally in a

prominent spot on the Downs or on other high land ; as a rule a trench was next dug round the grave at a distance of some, 15, 20, or 30 feet from the interment, and the whole of the material got out of the ditch was thrown over the grave, and so the burial mound was formed.

These cinerary urns are of varying shapes and sizes, their capacities ranging from less than a pint to more than a bushel.

INCENSE CUPS OR IMMOLATION URNS.—Very frequently small vessels of pottery which rarely exceed two inches in height are discovered with cremated interments ; sometimes they are within the mouths of the larger cinerary urns, sometimes standing close by them, and at other times they are the only accompaniments of interments which have not been deposited in urns.

The probable use of these little vessels is a moot question. Many archæologists term them incense cups under the supposition that they were the receptacles of incense burnt at the time of the cremation of the body. The forms of some certainly suggest that they were used for the purpose of burning some substance or other, and it may be that the sacred fire was carried in them to ignite the funeral pile. As they frequently contain burnt bones, another view as to their use has been promulgated, to the effect that they were intended to receive the ashes of infants sacrificed at the death of the mother, hence the name Immolation Urns.

DRINKING CUPS.—Perhaps the highest class of the Bronze Age pottery consists of the so-called drinking cups found with interments of this period. When discovered they contain no substance other than the material in which they are buried. Many specimens, though, are stained or encrusted up to a certain level, and the opinion is that they contained some liquid placed with the dead. When these vessels are discovered with the crouched skeletons they generally occupy a position at the feet, as may be seen from the illustrations in the volumes of "Pitt-River's Excavations."

FOOD VESSELS.—The so-called food vessels form another type of pottery principally accompanying unburnt bodies of this period. Like the drinking cups, they are usually found standing upright, and, where the mouths have been protected in such a way as to prevent any material falling into them, they are generally quite empty. Some, however, contain a little dirt or decayed organic matter, and they are supposed to have contained offerings of food placed with the dead. They are elaborately ornamented, even more so than the drinking cups. These two types of pottery, the drinking cup and the food vessel, seem, according to Dr. Thurnam's views, to have belonged to what we may term the table ware of the Bronze Age Britons.

ORNAMENTATION. — Another interesting feature of the pottery of this period is the ornamentation which consists principally of patterns of dots and straight and curved lines.

The dotted patterns on many of the drinking vessels for instance appear to have been produced with a small piece of wood or bone. In ornamenting many of the larger cinerary urns, however, the point of the finger or thumb was used to make the required dots of indentation ; and the study of this latter method led Dr. Thurnam to an interesting supposition. He states :— “ So far as I have been able to compare the size of the digitations, they point to the inference that the makers of our British fictilia, like the potters of the existing American and African tribes, and lately even the Hebrides, were of the female sex.”

The patterns in straight and curved lines are, as a rule, indented or incised, presumably with a pointed stick or bone, or by the impress of a twisted string of fibre or sinew.

SUN-DRYING OR SUN-BAKING.—The early archæologists expressed a view that many of the rude vessels of this period which have come down to us were baked or dried simply by exposure to the rays of the sun ; but such a view is utterly fallacious, for the experience of the modern potter shows that a temperature far in excess of our extreme summer heat is necessary to convert clay into pottery or terra-cotta, and so produce that chemical change in the clay which renders it, as pottery, the most durable of all manufactured substances.

Presuming the sun-drying process to have obtained among the Bronze Age Britons, then the percolation of water through the burial mounds would have resolved all such sun-dried specimens into their original clayey state, and this, combined with the varying temperature and other causes during the lapse of the intervening years, would have sufficed to crumble them to pieces, and none would have figured in our public and private collections to bear witness of the potter’s art of these far-off times.

CAMPS.—Few perfect examples of Bronze Age pottery other than those associated with the interments of this period have been discovered ; and the archæologist owes much to the interesting modes of sepulture of our prehistoric Celtic ancestors.

The entrenchments or fortified camps and the villages of the bronze-using Britons have, as yet, received scant attention in the way of methodical research. To my knowledge three only of these have been thoroughly investigated. These, all of the rectangular form, and situated in North Dorset, were excavated by the late General Pitt-Rivers. Previously to the excavation of these rectangular earth works the view held with regard to their age was that they were constructed during the period of the Roman occupation ; and I remember having seen this opinion stated in more than one local publication with reference to Hollingbury Camp, which is rectangular, and I believe the majority of Brightonians, who are aware of its existence, still tenaciously hold to this opinion. For my own part I do not imagine I am too sanguine in anticipating that an investigation of this camp, and

that of Highdown—another similar camp on the hills west of Cissbury—if it does not prove them to be of the Bronze Age, will, at least, reveal them to be pre-Roman works.

The pottery turned up in the camps of this period, is, as one may well imagine, of a fragmentary character, consisting as it does of the thousands of the shards of easily-broken domestic vessels. The majority of the fragments so found are of the texture and quality of the cinerary urns and other vessels used for sepulchral purposes. This, and the fact of the discovery in the filling of the ditches of several nearly complete urns in a fragmentary state similar to those used for cinerary purposes, seems to militate against the generally received opinion as to the class of vessels found with interments being manufactured exclusively for mortuary purposes.

IRON AGE.—The last phase of the prehistoric period with which we now have to deal is that lying between the introduction of the knowledge of the use of iron and the coming of the Romans in the first century B.C. In all probability this period was of short duration compared with that of the Bronze Age. Our knowledge of it is but scanty, and few examples of the pottery of this the early Iron Age have as yet been discovered. From the study of well authenticated remains, however, we gleam this much, namely, that the coast tribes of the south-eastern portion of Britain were in a variety of ways influenced by and had adopted many of the arts and customs of the Gauls who inhabited the neighbouring continental regions, and with whom they are in constant communication.

The Gaulish influence is most notable in the coinage as well as by the introduction of the potter's wheel, the use of which the continental tribes had probably derived by more direct contact with southern civilisation. This latter instrument enabled our prehistoric potter to impart grace and symmetry to his fickle productions, and its application is apparent from the forms of the majority of the best known examples of the so-called late Celtic pottery. The sketches I exhibit are of two such specimens found in Kent, and of the two discovered by General Pitt-Rivers in his excavation of the late Celtic pits in the interior of Mount Caburn Camp near Lewes. Mr. Park Harrison also found the fragmentary remains of two pots in similar pits dug by the tribes of the early Iron Age in the interior of Cissbury Camp. Fortunately these are in our Museum and are now exhibited, together with a very fine example of this class of pottery found at the bottom of Elm Grove during excavations for the foundations of a church. In shape, texture, and ornamentation, the latter closely resembles the specimens from Mount Caburn and Cissbury.

ROMAN BRITAIN.—Having passed the prehistoric periods of Britain in rapid review, that now remaining to form the conclusion of my paper is the Roman occupation. The duration of this, I

may remind you, was, roughly speaking, about 400 years. This long interval saw the Romans deeply implanting the seeds of our first civilisation, and to their chroniclers of this eventful time we owe the first written records of the history of England. But these early writings, valuable as they are, are sadly incomplete ; and it is the spade of the antiquary which has added a very material complement to the knowledge which we gather from the perusal of classic authors.

Turning our attention to the pottery of Roman Britain, we find what an enormous influence was exerted by the Romans in this direction. Huge factories of pottery, extending over many square miles, were established in various parts of the island, in which thousands of persons were constantly employed ; and numerous small local potteries sprang into being wherever clay of a suitable quality was obtainable in the vicinity of Roman stations and Romano-British villages. The wares thus produced were of a very varied character, and an endless number of vessels were fabricated.

The sites of the principal potteries brought to light by the investigations of the archaeologist are three in number, namely, the potteries near Sheerness in the Upchurch marshes on the banks of the Medway, those situated on the banks of the Severn in Shropshire, and those of the ancient city Durobrivae on the river Nen in Northamptonshire. The pottery from these districts exhibits different types and forms which are known respectively as Upchurch ware, Salopian ware, and Durobrivian or Castor ware. Similar wares are found scattered abroad all over the kingdom in connection with Roman and Romano-British remains, and it seems patent that the pots emanating from these centres formed an important trade item with these peoples, who used pottery for a variety of purposes which surpasses even that of the present generation. Further on we shall also see that pottery was imported from the factories of Continental Roman stations.

The marked superiority of the pottery of Roman Britain over that of the preceding barbaric times, becomes very evident when we examine even a fairly representative collection. Instead of the rude hand-made vessels which were baked in the open fire, we observe graceful and artistic forms which were moulded on a small revolving table or potter's wheel—the *orbis* or *rota figularis* of the Romans—and afterwards fired in properly constructed kilns. Many of these kilns in a perfect state of preservation have been laid bare on the sites of the principal potteries.

With such an array of pots and pans as that produced during the Roman occupation, a difficulty arises in selecting for description such examples as will be of service in a short account of this kind. Our attention, therefore, must be confined to the consideration of a few typical interesting forms and to local finds.

SAMIAN—The most beautiful and artistic of the Roman pottery discovered in Britain is the so-called Red Samian. This was highly esteemed and extensively used, and formed the table ware of the Romans and Romano-British aristocrats. The forms of the Samian vessels are very varied ; some are unglazed, but the finer and more ornamental examples are coated with an extremely thin glaze which gives them the appearance of a dull-red sealing wax. The term “Samian” was applied to this ware by the Romans themselves, although the generally received opinion is that it had no connection with the island of Samos. Whether the red ware fabricated in the Greek islands formed the prototype of Samian, or whether it was invented by a person named Samos, still remains a matter of doubt.

Both the classic authors and recent researches prove that the principal factory of this ware was at Aretium in Italy—the modern Arezzo—from whence it was exported to the distant Roman colonies, and by sale and barter, found its way among the barbaric tribes far removed from the sphere of Roman influence both in Europe and Asia Minor.

The question as to the constituents of the clay used in its manufacture and of the material employed in glazing still remains unanswered. No similar clay has been discovered ; and it is thought the red colour was obtained either by an admixture of highly ferruginous clays or by the addition of oxide of iron and lead.

Many of the vessels are quite plain, but the majority are highly decorated in high relief with scenes from the chase, daily life, and subjects from Roman mythology, among which appear elaborate embellishments of foliage and ornament. The makers' names also appear on much of this class of pottery in the shape of small labels stamped on the bottoms and sides, as may be seen on examining several specimens now on the table.

In the fabrication of this ware, especially of the more ornamental, a clay mould in one or several pieces was used. When the mould was in a plastic state the scenes and embellishments were impressed round its interior by means of stamps. When the mould was ready for making a Samian vessel, the interior was coated with a clay of the desired thickness, which was then well modelled and firmly pressed against the sides of the mould in order to take the external designs in relief. This being satisfactorily accomplished, it was set aside till the vessel had become properly dry and had shrunk sufficiently to admit of its being taken bodily from the mould ; deficiencies were then rectified, and, if properly dry, the vessel was ready to be submitted to the fire of the potter's kiln.

A few fragments of these moulds have been discovered in England, but it is generally agreed that the Samian ware was not produced here, but that it was obtained either from Aretium or

from the Samian factories in Germany and France. The potters of Roman Britain did, however, endeavour to imitate this choice ware by the same process of moulding, but their productions in this direction were comparatively poor. This is known as false or imitation Samian, the red colour of which was produced by dipping the clay into a slip or thick clayey liquid made of sulphate of iron. It is probable that the fragmentary moulds discovered in England were used by the British potters in their attempts to imitate the true Samian.

The forms and composition of the pottery produced by the Romanized Britons are practically identical with that of the Roman potters. The distinguishing characteristics of the former consist mainly in the ornamental patterns which are in many cases similar to or survival of those on the pottery and other artistic productions of the prehistoric periods.

But, even with this as a criterion, it becomes a matter of great perplexity to lay down any hard and fast lines of distinction between the pottery produced by the Roman potters and that made by the Britons under the influence of Roman art.

As the greater number of our local specimens have been discovered associated with interments in the cemeteries of the Romans and Romano-Britons, a short description of the burial customs of these peoples becomes a necessity. Until the introduction of Christianity in the Third Century, cremation was prevalent among the Romans. The ashes of the dead were carefully collected from the remains of the funeral pile and placed in a special cinerary urn, or, when this was unobtainable, in some domestic vessel,* as may be seen in the examples before you. It was then carried to the local cemetery, which was invariably situated by the roadside outside the precincts of the town or important station, or, in the event of the death occurring in the country, to the burial ground in the immediate neighbourhood of the villa or hamlet. The urn containing the cremation was then often buried enclosed in a much larger vessel or in a coffin to protect it from the superincumbent earth. A number of vessels of different descriptions were sometimes interred with the one containing the cremation; these were probably used at the funeral feast or were intended for the use of the spirit of the deceased in the world of the departed.

The burial customs of the Britons seem to have undergone

* At Wilderspool, an outskirt of Warrington, a great deal of interesting Roman pottery was discovered some years ago, among which were two *tetinae*, or feeding bottles. "When found the mouth of each was covered by a fragment of pottery, and from their upright position and contents, there can be no doubt that they contained the ashes of one or more children."—JEWITT, *Ceramic Art*, p. 41.

a great change under the influence of the Romans, and the most recent researches tend to show that comparatively little care was bestowed upon the dead of the poorer classes. In many cases the bodies are found pitched pell-mell into their refuse pits, an instance of which was exhumed not long since at Portslade, but sometimes an apology for a grave was made in the drains and ditches surrounding their villages and camps. The secondary interments in the barrows of the preceding periods also show that these were used as burial-places both by the Romans and Romano-Britons.

Broaching the subject of the fictile remains of the Romans and Romano-Britons in Sussex, we find that the more notable examples have been exhumed near Brighton, in the cemeteries in the neighbourhood of Portslade, the approximate site of the Portus Adurni* of the Romans, and at Seaford, Hassocks, and Hardham in West Sussex. Taking the pottery found by Professor Boyd Dawkins in the Romano-British cemetery at Hardham, we observe the majority of the vessels are of a dark-coloured ware. This colouring, together with the forms and ornamentation of several of the vessels, resembles the Upchurch ware, and the black colour is supposed to have been produced by merely smothering the fire of the kiln and so sending volumes of smoke through the chamber containing the pots in process of baking.

Another interesting discovery made at Hardham previously to Professor Boyd Dawkins' investigations, is the large amphora now before you. "With the exception of a coin of Hadrian, and another Roman coin, it contained nothing but a quantity of dark matter, which, in all probability, consisted of the ashes of the dead. Before it had been used for sepulchral purposes, it had lost the neck and handles, and a crack, which must have rendered it useless for holding wine, prevented from extending by two leaden rivets, was probably the cause of its being used to cover human ashes" ("Sussex Arch. Coll.", vol. xvi., p. 51). Of the other perfect amphora exhibited, all information has unfortunately been lost; it is probable, however, that it is a modern foreign production.

Another class of pottery figuring in our local collection is that known as the New Forest ware, owing to the discovery of its most typical forms at kilns in the New Forest. The two well-known kinds are the cream-coloured and the hard; the vessels of the latter division are usually decorated with fluted indentations made by the thumb or finger whilst they were in a plastic state. This ornamentation also occurs on specimens of the Castor ware.

Probably the most artistic little pot we possess from Portslade is that under the glass shade. It is a typical specimen of

* Aldrington; Scarth, *Celtic Brit.*

the ornamental Castor ware, and is made from a fine white clay, and decorated with the figures of three dogs in high relief. These figures were not moulded after the manner of the Samian ware, but, when the pot had been plainly modelled on the wheel, a clay, of the same colour as the body of the pot, was prepared and diluted with water till it had attained the consistency of a thick cream ; the figures and other ornamentation in relief were then produced by laying on the slip or clayey liquid by means of small pointed sticks. The black colour of the surface of the vessel is, in all probability, due to the smoke of the kiln. In painting designs on pottery the Romans displayed little skill, the only ornamentation of this kind consisting of a slip of red, white, or yellow clay, put on with a brush in coarse bands or scroll patterns.

I have also brought forward for exhibition the fragmentary remains of a mortarium. This class of vessel was extensively used, if we may judge by the number found with Roman remains, and it is thought they were employed in the culinary department for pounding and beating up vegetables and other articles. My sketch shows the general form of these vessels.

Sussex is extremely rich in pre-historic remains. Few of the hill forts have been methodically investigated ; but, whenever such excavations are put in progress, the broken shards of pottery will form the most valuable evidence as to the periods of their construction and of subsequent occupation by other tribes and races.

And so, ladies and gentlemen, I think no apology is needed for this popular paper, in which I have overhauled the pots, bones, and dust-heaps of pre-historic and early historic times. In his admirable little book on "Evolution in Art," Professor Haddon states that "perhaps no manufacture is of such importance to anthropologists as pottery. Earthenware vessels are comparatively easy to make, and though they are brittle, their fragments, when properly baked, are almost indestructible. The history of man is unconsciously written largely on shards, and the elucidation of these unwritten records is as interesting and important as the deciphering of the cuneiform inscriptions on the clay tablets of Assyria." (p. 97.)

FRIDAY, APRIL 26TH, 1901.

DISCOVERY OF A
**Mummied Toad in a Flint Nodule,
 FOUND AT LEWES, SUSSEX.**

(Now in Mr. Henry Willett's Collection, Brighton Museum.)

BY

**CHARLES DAWSON, Esq.,
 F.G.S., F.S.A., Etc.,**

Honorary Member of the Brighton and Hove Natural History and Philosophical Society.

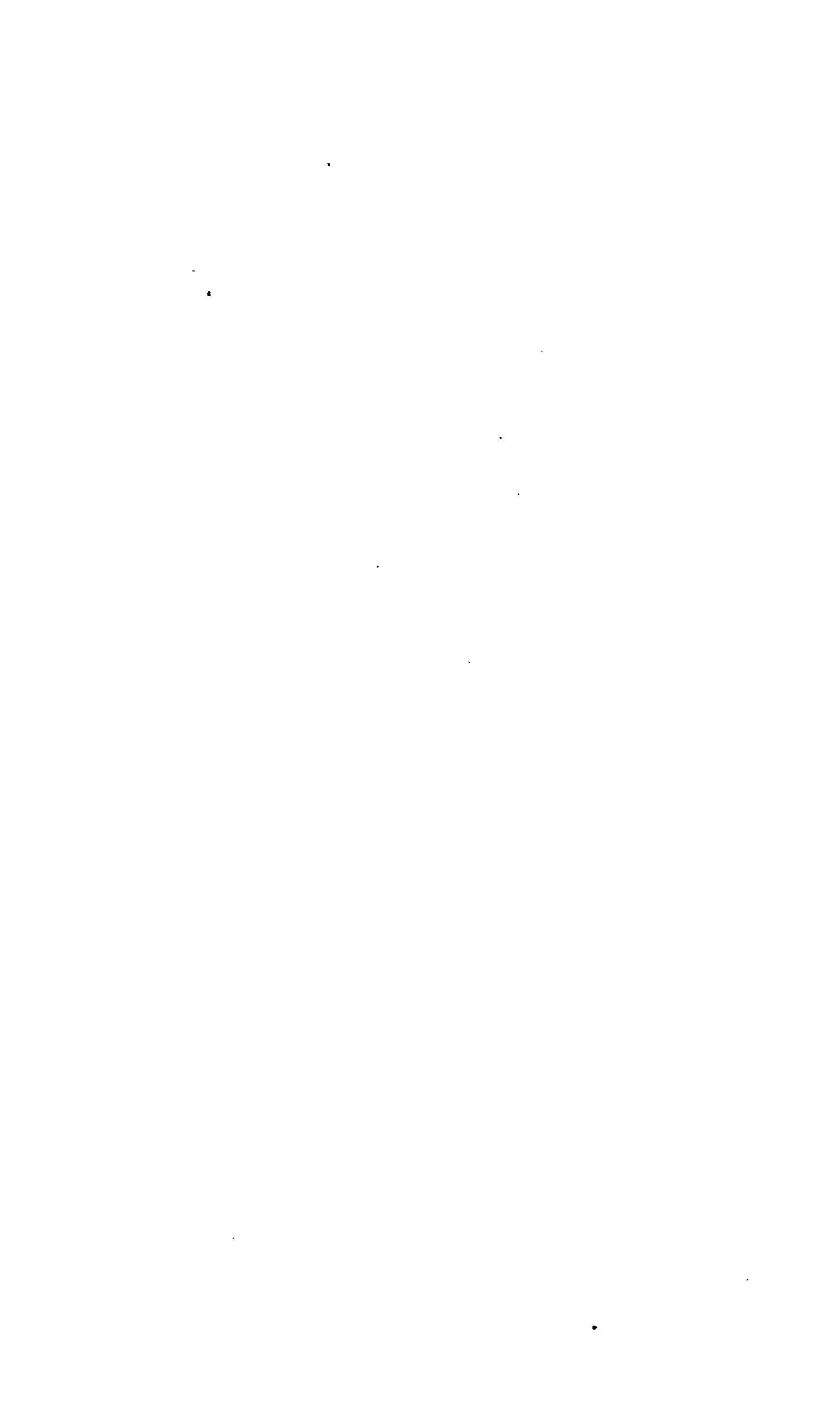
MR. DAWSON opened his subject by referring to the early mention, by Lord Bacon and Dr. Plot, of entombed toads. He also remarked that abundance of notices had appeared in *The Zoologist*. The best series of instances had been collected by Mr. P. H. Gosse, F.R.S., in his *Romance of Natural History* (second series).

Referring to the recent discovery of a specimen in Sussex, and then exhibited to this Society, Mr. Dawson said :— A mummied toad in the hollow flint nodule was discovered at Lewes by two workmen named Mr. Thomas Nye and Mr. Joseph Isted, about two summers ago.

The nodule was lying with others on the side of the road, to be used as road metal, and the flints had been obtained from a neighbouring quarry at the base of the Downs, to the North-East of Lewes. It was thickly covered with a crust of chalk, and attracted the attention of the men by its peculiar shape, being in form like a large citron (present size—length, $5\frac{1}{2}$ inches; circumference, 12 inches; diameter, 4 1-8th inches).

The comparative lightness of the stone induced Mr. Nye to break it open, when, in a hollow in the centre, was discovered the mummied toad, encrusted with chalky matter, together with a loose mass of fine white chalk (with sponge-spicules), and "pith" (presumably portions of a fossil sponge).

The hole communicating with the cavity to be seen at the narrow or pointed end of the stone was not then opened, but was filled with silted chalk, which rendered it almost invisible, as will



:seen in the photographs.* Mr. Nye carried the specimen
as a curiosity.

The same day that it was found, Dr. J. Burbidge, of Lewes, informs me it was brought to him. He obtained the loan of it for a considerable time, and Mrs. Burbidge took three small photographs of it. Dr. Burbidge says that he is acquainted with Mr. Nye, and has professionally attended his family for some years, and believes him to be honest and trustworthy. I have also carefully questioned both the men, who have given a consistent account of the discovery. From other enquiries I have found them to be of good report.

The rare and fortuitous nature of most of these discoveries renders the probabilities so much in favour of their being made by unscientific persons, that we must, perforce, receive with suspicion, but with respect, the only *possible* evidence, where it proves to be reasonable and consistent.

Unfortunately, while on loan, the smaller piece of the flint, now forming the lid of the cavity, was again accidentally fractured, while in the possession of Dr. Burbidge, and was cemented again by him. The specimen was returned to Mr. Nye, who refused to part with it, and was somewhat annoyed at its breakage, declining to trust it elsewhere.

The late Mr. C. T. Phillips, Curator of the Castle Museum, Lewes, entered into negotiation with Mr. Nye for its purchase, but, owing to the sudden death of the former gentleman, the matter dropped, although Mr. Nye had, at that time, entertained the question of parting with it to a local Museum, in preference to selling it privately.

My attention was first drawn to the matter, soon after the discovery, by Mr. John Lewis, C.E., F.S.A., who shewed me the three small photographs of the specimen, which had been given to him by a friend at Lewes, but he told me that he had not seen the specimen itself. On seeing the photographs, and not being able to detect any trace of organic structure, I regarded the toad-like object in the flint as merely bearing an accidental, though striking, resemblance to a toad. Mr. Lewis gave me the photographs, which I kept, regarding the object in the hollow of the flint as being an example of the curious imitative resemblances flint stones often assume. The same *a priori* conclusion has been come to by every geologist of repute who has yet, *alone*, seen the photographs.

It was not until March of the present year that, on turning over some photographs, I again by chance came upon these three photographs, and as I thought the specimen itself would be interesting to possess, I commenced to make inquiries as to its whereabouts. After considerable trouble, I found it still in the

* I have photographed the hole in its original condition.

possession of Mr. Nye. I then discovered to my surprise that the object in the flint was a mummied or desiccated toad covered with a slight deposit of chalky matter.

I purchased the specimen from Mr. Nye on the understanding that it should be presented to the Brighton Museum (Mr. Henry Willett's Collection), and that his name should be associated with its discovery.

The mummied body of the toad, which is $2\frac{1}{2}$ inches long, appears to fit in with certain irregularities in the floor of the cavity, the skin having probably sunk into them during the time when the body was drying.

I find, on examination of the nodule, that the hollow had probably once been occupied by a sponge around which the flint had formed. The sponge had decayed leaving a cavity within the flint, and the decay of its stem had left a round hole at the lower or pointed end of the stone. I found on piercing the hole that it was filled only with chalk (diameter of hole half an inch). Through this hole the animal when small must have crawled into the cavity. A day must soon have come when the toad could no longer get out, and it could only have subsisted upon such insects and other small organisms as came within reach of its tongue. How long it remained there cannot be estimated, but it probably did not long survive the silting up of the hole.

Experiments have shown that the growth of these animals is greatly accelerated by abundance of food and retarded by want of it. Indeed, it seems that under certain conditions they may even shrink in size; but without food there can be no real increase in substance. The amount of food reaching the toad also cannot be estimated; much would depend on the situation of the stone when the animal was entombed. Supposing, for instance, that the nodule was protruding from its bed in the chalk at the bottom of a long crevice, down which the toad had fallen, the supply of insects would have been very small.

On the other hand, it may have been then situate on the surface, in the vicinity of some decaying or other matter which might have attracted insects and other organisms to the vicinity of the orifice of the nodule.

There is another problem to which I should like to draw the attention of naturalists, viz.: as to whether the fetid and acrid exudations from the skin of toads may not attract flies, insects, and other organisms towards these creatures, so as to cause them to come within range of their long, elastic tongues?

Again, a toad has a peculiar method of softly scratching the ground with its hind claws when preparing to strike its prey; which noise or vibration may, perhaps, be a cause of attraction to certain insects. Such factors as these, or the mere perception of the presence of moisture by insects, &c., may have induced them to enter the hole in this nodule (or in other cases the

crevices in which toads are found entombed), and in such quantities that the animal might exist and grow.

Dr. Buckland's interesting experiments (1825-1827) with imprisoned toads were entirely directed against the well known theories that entombed toads had existed from the Geological era, when the matrix which enclosed them was supposed to have formed around them.

It is useless now to discuss this question, because every reasonable person now realizes the absurdity of the supposition of a living toad becoming the nucleus of a flint nodule at the bottom of the ocean, or being preserved alive in hollows in the Coal Measures (from the time of their original formation), where all associated remains show evidence of the enormous pressure to which they have been subjected.

Dr. Buckland's experiments are, however, very interesting, and an abstract of his records are here given.

"On the curious question, whether toads live, as reported, in holes in stones, Dr. Buckland, of Oxford, has published an account of some rather cruel experiments, namely :

On the 26th of November, 1825, he placed one live toad in each of twenty-four cells, twelve in coarse, and twelve in compact siliceous limestone, with a double cover of glass and slate placed over each of them, and cemented down by the luting of clay.

The weight of each toad, in grains, was ascertained, and the large and small ones were distributed in equal proportion between the limestone and the sandstone cells.

These blocks of stone were then buried together beneath three feet of earth, and remained unopened until the 10th of December, 1826.

Every toad in the smaller cells of the *compact* sandstone was dead, and the bodies of most of them so much decayed that they must have been dead some months.

The greater number of those in the larger cells of *porous* limestone were alive. No. 1, whose weight when immured was 924 grains, now weighed only 698 grains.

No. 5, whose weight when immured was 1,185 grains, now weighed 1,265 grains. The glass cover over this cell was slightly cracked, so that minute insects might have entered; none, however, were discovered in this cell.

But in another cell, whose glass was broken, and the animal within it dead, there was a large assemblage of minute insects, and a similar assemblage also on the *outside* of the glass of a third cell.

In No. 9, a toad, which weighed 988 grains, had increased to 1,116 grains, and the glass cover over it was entire. No. 11, had decreased from 936 grains to 652.

Before the expiration of a second year, all the large ones also were dead.

These were examined several times during the second year through the glass covers of the cells, but without removing them to admit air. They appeared always awake with their eyes open, and never in a state of torpor, their meagreness increasing at each interval in which they were examined, until at length they were found dead.

Those two also which had gained an accession of weight at the end of the first year, and were then carefully closed up again were emaciated and dead before the end of the second year.

At the same time that these toads were enclosed in stone, *four other toads* of middling size were enclosed in three holes cut on the North side of the trunk of an apple-tree, two being placed in the largest cell, and each of the others in a single cell. The cells were nearly circular, about five inches deep, and three inches in diameter. They were carefully closed up with a plug of wood, so as to exclude access of insects, and, apparently, were air-tight. When examined at the end of a year, every one of the toads was dead, and their bodies decayed.

And besides the toads enclosed in stone and in wood, *four others* were placed each in a small basin of Plaster of Paris, four inches deep and five inches in diameter, having a cover of the same material carefully 'luted' round with clay. These were buried at the same time, and at the same place, with the blocks of stone, and on being examined at the same time with them in December, 1826, two of the toads were dead, the other two alive."

Dr. Townson recorded a series of observations which he made on tame frogs, and also on some toads; these were directed chiefly to the very absorbent power of the skin of these animals, and show that they take in and reject liquids, through their skin alone, by a rapid process of absorption and evaporation, a frog absorbing sometimes in half an hour as much as half its own weight, and in a few hours the whole of its own weight of water, and nearly as rapidly giving it off when placed in any position that is warm and removed from moisture. Dr. Townson contended that as the frog tribe never drink water, this fluid must be supplied by means of absorption through the skin. Both frogs and toads have a large bladder, which is often full of water: "Whatever this fluid may be," he says, "it is as pure as distilled water and equally tasteless; this I assert, as well of that of the toad which I have often tasted, as that of frogs." Dr. Townson found both frogs and toads perfectly harmless and innoxious.

When specimens of entombed toads and frogs have been discovered from time to time by unscientific people, the finders usually preserve only either the toad or the stone in which it is reported to have been found.

I am not aware that any complete specimen *in situ* has ever before been brought to scientific observation.

To summarise the whole question of these reported discoveries

I think we may infer that the stories of toads being found alive in rocks and in the hearts of trees arise from the following circumstances:—Toads when small will often creep into holes in rocks and hollows in trees, and in these situations they may find sufficient food; being slothful in their habits, and capable of existing upon but little food, and of abstaining from it for a long time, they are apt to remain in their snug quarters and content themselves with what insects, &c., may come to them. In this way they may grow too large to get out of the hole, and live for a great time in it; when chance discovers them, by the rock being broken open or the wood of the tree cleft, the opening into which they had crept, and which may have been subsequently closed, is then entirely overlooked.

WEDNESDAY, JUNE 19TH, 1901.

Roger Bacon :
A CHAPTER IN THE HISTORY OF SCIENCE IN THE
13th CENTURY.

R. J. RYLE, M.D.

THE 13th Century has been called a precocious age. It was the age of Simon de Montfort, the pioneer of English statesmanship. It was the age of Dante. It was the age of Thomas Aquinas and Duns Scotus. Roger Bacon deserves to be remembered among the great ones of this period, for he was among the first to advocate the claims of the Sciences at a time when nearly all around were either indifferent or actively hostile.

He was born of good family in the year 1213, and he studied both in Oxford and at Paris. Somewhat early in his career he joined the Franciscan Order, being led to take this step (in all probability) by the fact that the students of this Order were at this time enjoying the great advantage of the direct teaching of Robert Grossteste, afterward Bishop of Lincoln.

The works of Roger Bacon which we have had the following origin: About the year 1264 Pope Urban VI. had sent one of his cardinals to England. This Cardinal became acquainted with Roger Bacon. A few years later this Cardinal himself became Pope, with the title of Clement IV., and soon after his elevation to the Papacy he wrote to Roger Bacon and requested copies of his writings.

Although at that time the learned friar seems to have published nothing, he began immediately to write, and within 18 months he had produced the "Opus Majus," the "Opus Minus," and the "Opus Tertium." The first of these works is the one by which he is chiefly known.

It is an eloquent exposition of the claims of genuine learning, and it is at the same time an appeal for reformation in the modes which were then current for the building up of knowledge. It is an appeal for the study at first hand of Greek and Hebrew writings, the wisdom contained in which was at that time only delivered to the student in the form of very meagre summaries and commentaries, many of which were themselves based not

upon the originals but upon Arabic versions. It is also an appeal for the cultivation of mathematics and for the freer use of observation and experiment. Lastly, it is an exposition, in clear and vivid, if not always classical, Latin, of certain leading branches of Science which Bacon had studied himself. Whewell has spoken of the work as at once the *Encyclopædia* and the *Novum Organon* of the 13th Century. It makes no pretensions to the teaching of any systematic doctrine as to the philosophy or logic of Induction, nor did Roger Bacon attempt the sort of reformation which at the time of Galileo had developed into organized revolt against the teaching of Aristotle, and the authority of the Church as touching matters of Science. Nor does the work contain record of original discoveries. Ptolemy and the Arabian Alhazen were the sources of the greater part at least of Bacon's physical and astronomical learning.

It is not likely that he invented gunpowder, for it seems to have been known before his day. The use of magnifying glasses, too, was known before his time, and the claim made for him by Draper in his "History of the Intellectual Development of Europe" that he described the true theory of the telescope is extravagant, and seems to be based on a very vague statement in one of Roger Bacon's works to the effect that by means of optical contrivances distant things could be made to look as if they were near, and things low down may be made to appear high up, and so on.

The first part of his great work deals with the four chief causes of human ignorance. These are: (1) The influence of weak and unworthy authority. (2) The influence of custom. (3) The influence of the opinion of the ignorant multitude. (4) The desire to conceal ignorance under an ostentatious display of learning.

These four causes of human ignorance he describes as being stumbling blocks in the way of wisdom, and as being the source of all the ills which befall the human race.

The second division of the *Opus Majus* is devoted to proving that Theology is the one Science which is the mistress of all others, and that all learning originally was conveyed in the form of supernatural wisdom to the descendants of Noah. There is one perfect wisdom, which is contained in the sacred Scriptures.

The third division of the work discusses the utility of grammar. It is a vigorous defence of the value of knowledge of languages. The late Professor Max Muller gives this treatise the credit of being in its way a sort of attempt at an introduction to the Science of Philology.

The fourth part of the book is the one upon which the author chiefly prided himself. It is an exposition of what Roger Bacon calls Mathematics, and under this term is included what was then known of Geometry, Astronomy, Mechanics, and Geometrical Optics. It is in this work that we find the celebrated

appeal made by Roger Bacon to the Pope for the rectification of the Julian Calendar, which rectification was in fact not accomplished, so far as the country of Roger Bacon is concerned, till 1751. Mathematics, he tells us, hold the keys of all the Sciences. A large part of the treatise deals with the geometrical data of optics. A good and complete description is given of the anatomy of the eye, although he seems to have missed the optical function of the crystalline lens. Atmospheric refraction is described (after Alhazen) and the opinion is expressed that the moon and stars shine by means of a kind of phosphorescence induced by exposure to sunlight.

A whole book is devoted by Roger Bacon to an exposition of what he calls "Scientia Experimentalis." By this phrase he means knowledge due to direct apprehension or experience, as contrasted with knowledge which is the result of processes of reasoning.

In illustration of the merits of the method of experience we have a full and interesting study of the rainbow. The account given of it is, of course, very inadequate, as, indeed, any account, previous to Newton's discovery of the different refrangibilities of the components of white light, must be.

Nevertheless, it contains some capital bits of inductive study.

"Let the experimenter (he says) take hexagonal stones from Ireland or India which are called Frides (probably quartz crystals) and let him hold them in a ray of sunlight coming through a window. He will find all the colours of the rainbow projected upon any opaque object held behind it, and arranged in the order in which they occur in the rainbow. . . Then let him observe men rowing, and watch the drops as they fall from the oars. It is the same with the drops which fall from a water mill, and if on a summer morning a man will look at the dew drops which cling to the grass in a garden or a field he will still find the same colours." Further on he gives some less satisfactory examples of *Scientia Experimentalis* as bearing upon the problem of preventing old age. He tells us, for instance, of a pot of excellent ointment which a man anointed himself withal and lived in consequence without decay for many hundreds of years. But by an unlucky oversight the fortunate possessor of the excellent ointment had forgotten to anoint the soles of his feet. Accordingly they were not preserved from decay, "and so it was that the man was always seen on horseback."

The question of the relation of the later Bacon,—the Lord Verulam of the *Novum Organon*,—to the earlier Roger Bacon is of interest. The four stumbling blocks in the way of wisdom, already mentioned as occurring near the beginning of the *Opus Majus*, have been compared with the four "Idola" of Francis Bacon; but their superficial resemblance becomes less striking

on closer examination. Certain words, also, such as the adjective *prerogative*, are common to both writers. And there was much in common in the aims of the two men. Both had great faith in progress. Both recognised the close bond of alliance which unites the several sciences. Both teachers insisted on the importance of a closer study of Nature by observation and experiment. But the resemblances are much greater in the general spirit of the two than they are when their writings are closely compared. Francis Bacon recognised and taught emphatically the evils of mixing theology with science. Roger Bacon continually insists on the theological form of the argument from final causes, and makes constant appeal to Scriptural and patristic literature in proof of physical facts. Had Francis Bacon been acquainted with the *Opus Majus*, the frequent examples of this form of unscientific method which occur therein would almost certainly have elicited some note of censure. Roger Bacon strove by teaching and by practice to set men on to the investigation of Nature by Induction, but he never attempted to formulate the rules of its employment, or to distinguish the processes by which general laws of Nature are arrived at through successive generalisations from the data of observation. Francis Bacon, on the other hand, did aim at doing for the philosophy of discovery what had been already done by Aristotle for the philosophy of argument. In this respect no amount of credit which Roger Bacon may deservedly receive for his work can impair the reputation of the author of the *Novum Organon*. The distinctive doctrines of the *Novum Organon* were not borrowed from the work of Roger Bacon, because they were not there to borrow.

There is, however, no doubt that if we compare the two Bacons as men of Science, we must rank the old friar above the Lord Chancellor. While Francis Bacon does not shew a close personal acquaintance with the sciences of his day, Roger Bacon on the other hand was evidently himself a thoroughly trained scientific worker, familiar with the use of astronomical apparatus and of astronomical and other numerical data.

We may keep a niche in the Temple of Science for the figure of the old friar who was the first in the line of modern physicists, and although his own generation rejected him we may recognise his voice across the intervening centuries as that of a true herald of the present age of Science.

WEDNESDAY, JUNE 12TH, 1901.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 12TH, 1901.

There is little of any special importance in the annals of the Society to record during the past year. The Lecture entitled "Autocrats and Fairies," given by Mr. Enock, to which the public were admitted on payment, resulted in so small a loss that it will probably be in the interests of the Society to repeat the experiment. In order to obtain records of facts and phenomena of interest, and which may be of importance from a Natural History point of view,—such as the date of the appearance and disappearance of certain birds and insects, or the scarcity or abnormal abundance of them at different seasons, &c.,—notice has been sent to all Members that Mr. W. W. Mitchell, of 66, London Road, has kindly offered to take charge of a book in which such observations as may be sent to him by Members will be entered.

As other Societies are adopting the same course, it is to be hoped that Members generally may take an interest in the scheme, so that the results obtained in different districts will admit of comparison.

During the past year fourteen new Members have been enrolled, eleven have resigned, one has died, and five have been struck off the list.

The Excursions have been as follows:—

- 1900. May 12th. Friar's Oak and Danny Park.
- ,, June 21st. Maresfield.
- 1901. May 14th. Shoreham and Steyning.

Papers read before the Society at its Ordinary Meetings:—

- 1900. Oct. 10th. "The Amateur in Science."—

Mr. W. CLARKSON WALLIS.

- ,, Nov. 13th. "The Ancient Beaches of Brighton and their Microscopical Contents."—

Mr. FRED. CHAPMAN, A.L.S., F.R.M.S.

1900. Dec. 12th. "Evening for Exhibition of Specimens—
Microscopic and others."
1901. Jan. 25th. "Among the Books."—Mr. H. DAVEY, Jun.
- " Feb. 13th. "How Electricity is Measured."—
Mr. E. PAYNE, M.A.
- " Mar. 13th. "The Pottery of Pre-historic and Roman
Britain."—Mr. H. S. TOMS.
- " Mar. 27th. "Natural Colour Photography."—
Mr. D. E. CAUSH and Mr. J. WILLIAMSON.
- " April 26th. "Discovery of Toad in Interior of Flint."—
Mr. C. DAWSON, F.S.A., F.G.S.
- " May 16th. "Friar Bacon: A Chapter in the History of
Science in the 13th Century."—
Dr. R. J. RYLE.
- " June 12th. Annual General Meeting.

In addition to these there has also been the following Lecture
to which the public were admitted on payment:—

1901. Feb. 26th. "Autocrats and Fairies."—

Mr. FRED. ENOCK.

LIBRARIAN'S REPORT.

Although 120 books and serials have been lent out during
the past year, showing a slight increase, yet only a few of the
Members make use of the Society's Library.

The splendid collection of 328 volumes, presented to the
Society last year by Mr. J. E. Haselwood, includes a number of
books of which the Society already contained copies; it has
therefore been decided that duplicates shall be valued and offered
to Members for Sale.

The publications of the Smithsonian Institution, received by
exchange, have this year included Part 1 of an important Mono-
graph on the American Hydroids, and Part 4 of the Fishes of
Northern and Central America.

The 9th and last volume of Buckler's monumental work on
the Larvæ of British Lepidoptera, published by the Ray Society,
has been received.

H. DAVEY, JUNR.,
Hon. Librarian.

METEOROLOGICAL REPORT.

In the Table printed on the opposite page the main meteorological features of the twelve months—July, 1900, to June, 1901,—are contrasted with the averages of the corresponding records for the years 1877 to 1900.

The rainfall was very much below the average, the amount in September being only a quarter of the average amount for the years 1877 to 1900. In the first week in August, 1900, a considerable amount of rain fell, culminating in a fall of 0·42 inches on Bank Holiday, August 6th. The lowering of the temperature, and the cleansing of the streets caused by this rainfall, led to a considerable reduction in the usual autumnal mortality from epidemic diarrhoea, the amount of this troublesome infantile complaint being much less in 1900 than in preceding years.

The accompanying Table, dealing with the years (January to December) 1877 to 1900, shows that we have been passing through a cycle of dry years which still continues. The accumulated deficiency of rainfall since 1886 has been 35·71 inches.

Since the beginning of March, 1899, a record of rainfall has been kept on my behalf by Mr. Mitchell, the Head Master of Pyecombe School. The differences between this record and that of Brighton are shown in the following table:—

	PYECOMBE.	BRIGHTON.
1899 (March to December) ...	22·73	18·00
1900	35·83	27·83
1901 (January to June) ...	11·52	7·52
	<hr/>	<hr/>
	70·08	53·35

Thus, during the period of 28 months, 16·73 more inches of rain fell at Pyecombe than in the Old Steine, Brighton.

Deviation from Average Rainfall (29·13 inches) of 24 years, 1877-1900.

YEAR.	DEFICIENCY.	EXCESS.	ACCUMULATED DEFICIENCY.
1887	... 7·03	...	7·03
1888	... 0·97	—	8·00
1889	... 1·68	—	9·68
1890	... 5·52	—	15·20
1891	... —	5·25	9·95
1892	... 2·66	—	12·61
1893	... 5·00	—	17·61
1894	... —	2·82	14·79
1895	... 3·94	—	18·73
1896	... 1·29	—	20·02
1897	... 0·01	—	20·03
1898	... 8·72	—	28·75
1899	... 5·66	—	34·41
1900	... 1·30	—	35·71

ARTHUR NEWSHOLME.

MONTH.	TEMPERATURE OF AIR DURING MONTH.					Mean.	Lowest.	Highest.	WEATHER					Number of Days of Rainfall.	Number of Days on which Rain fell.	Amount collected in Inches.	Number of Sales Days.	Number of Hours recorded.	SUMMARY.			
	N.	E.W.	S.	E.E.	N.N.E.				W.	N.W.	Cloud.	Rain.	Fall.						Wind.	Cloud.		
July,	1900	81.2	78	73	75	74	79	80	78	80	85	85	85	85	85	85	85	80.00	1	113	64	
"	1877-1900	85.9	82.5	82.1	82.8	82.9	83.0	83.2	83.0	83.2	83.5	83.7	83.8	83.9	83.9	83.9	83.9	82.41	1	113	64	
August,	1900	85.9	82.5	82.1	82.8	82.9	83.0	83.2	83.0	83.2	83.5	83.7	83.8	83.9	83.9	83.9	83.9	82.41	1	113	64	
"	1877-1900	85.9	82.5	82.1	82.8	82.9	83.0	83.2	83.0	83.2	83.5	83.7	83.8	83.9	83.9	83.9	83.9	82.41	1	113	64	
September,	1900	83.2	80.2	79.0	79.4	79.5	79.6	79.7	79.5	79.7	80.0	80.2	80.3	80.4	80.4	80.4	80.4	79.51	1	113	64	
"	1877-1900	83.2	80.2	79.0	79.4	79.5	79.6	79.7	79.5	79.7	80.0	80.2	80.3	80.4	80.4	80.4	80.4	79.51	1	113	64	
October,	1900	74.9	70.4	67.9	65.9	63.9	61.9	59.9	61.9	63.9	65.9	67.9	69.9	71.9	73.9	75.9	73.9	67.94	1	113	64	
"	1877-1900	74.9	70.4	67.9	65.9	63.9	61.9	59.9	61.9	63.9	65.9	67.9	69.9	71.9	73.9	75.9	73.9	67.94	1	113	64	
November,	1900	68.2	65.2	62.9	60.9	58.9	56.9	54.9	56.9	58.9	60.9	62.9	64.9	66.9	68.9	70.9	68.9	62.94	1	113	64	
"	1877-1900	68.2	65.2	62.9	60.9	58.9	56.9	54.9	56.9	58.9	60.9	62.9	64.9	66.9	68.9	70.9	68.9	62.94	1	113	64	
December,	1900	63.5	61.4	59.4	57.4	55.4	53.4	51.4	53.4	55.4	57.4	59.4	61.4	63.4	65.4	67.4	65.4	59.44	1	113	64	
"	1877-1900	63.5	61.4	59.4	57.4	55.4	53.4	51.4	53.4	55.4	57.4	59.4	61.4	63.4	65.4	67.4	65.4	59.44	1	113	64	
January,	1900	60.1	58.1	56.1	54.1	52.1	50.1	48.1	50.1	52.1	54.1	56.1	58.1	60.1	62.1	64.1	62.1	56.14	1	113	64	
"	1877-1900	60.1	58.1	56.1	54.1	52.1	50.1	48.1	50.1	52.1	54.1	56.1	58.1	60.1	62.1	64.1	62.1	56.14	1	113	64	
February,	1900	54.9	52.9	50.9	48.9	46.9	44.9	42.9	44.9	46.9	48.9	50.9	52.9	54.9	56.9	58.9	56.9	50.94	1	113	64	
"	1877-1900	54.9	52.9	50.9	48.9	46.9	44.9	42.9	44.9	46.9	48.9	50.9	52.9	54.9	56.9	58.9	56.9	50.94	1	113	64	
March,	1901	53.4	51.3	49.3	47.3	45.3	43.3	41.3	43.3	45.3	47.3	49.3	51.3	53.3	55.3	57.3	55.3	49.34	1	113	64	
"	1877-1900	53.4	51.3	49.3	47.3	45.3	43.3	41.3	43.3	45.3	47.3	49.3	51.3	53.3	55.3	57.3	55.3	49.34	1	113	64	
April,	1901	52.4	50.4	48.4	46.4	44.4	42.4	40.4	42.4	44.4	46.4	48.4	50.4	52.4	54.4	56.4	54.4	48.44	1	113	64	
"	1877-1900	52.4	50.4	48.4	46.4	44.4	42.4	40.4	42.4	44.4	46.4	48.4	50.4	52.4	54.4	56.4	54.4	48.44	1	113	64	
May,	1901	50.4	48.4	46.4	44.4	42.4	40.4	38.4	40.4	42.4	44.4	46.4	48.4	50.4	52.4	54.4	52.4	46.44	1	113	64	
"	1877-1900	50.4	48.4	46.4	44.4	42.4	40.4	38.4	40.4	42.4	44.4	46.4	48.4	50.4	52.4	54.4	52.4	46.44	1	113	64	
June,	1901	48.2	46.2	44.2	42.2	40.2	38.2	36.2	38.2	40.2	42.2	44.2	46.2	48.2	50.2	52.2	50.2	44.24	1	113	64	
"	1877-1900	48.2	46.2	44.2	42.2	40.2	38.2	36.2	38.2	40.2	42.2	44.2	46.2	48.2	50.2	52.2	50.2	44.24	1	113	64	
Entire Year					81.4	79.4	77.4	75.4	73.4	71.4	69.4	67.4	65.4	63.4	61.4	59.4	57.4	55.4	53.4	49.44	64	64
Average of 1877-1900					80.4	78.4	76.4	74.4	72.4	70.4	68.4	66.4	64.4	62.4	60.4	58.4	56.4	54.4	52.4	48.44	64	64

1877-1900

Average of 1877-1900

Brighton and Hove Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 12th JUNE, 1801.

HERBARIUM.

The following plants have been added since last Report :—

Fumaria confusa.	Uckfield.
Lepidium Smithii.	Telscombe.
Elatine hexandra.	Piltdown.
Rubus plicatus, var Bertramii.	Wiggenholt Common.
Caucalis latifolia.	Kingston-by-Sea.
Caucalis daucoides.	" "
Galium verum, b. ochroleucum.	Camber Sands.
Galium anglicum.	Between Seaford and
Crepis foetida.	Alfriston.
Plantago lanceolata var. timbali.	Preston.
Chenopodium opulifolium.	Southwick.
Chenopodium rubrum, b. pseudo- botryoides.	
Malaxis paludosa.	Bramber.
Iris foetidissima.	Lewes.
Ruppia rostellata.	Amberley.
Eleocharis acicularis.	Wannock Glen.
Carex strigosa.	Southwick.
Panicum Crus-galli.	

T. HILTON,
Curator.

RESOLUTIONS, &c., PASSED AT THE 48th ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Librarian's Report be received, adopted, and printed for circulation as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“Mr. J. E. Haselwood, Dr. A. Newsholme, Mr. D. E. Caush, Mr. E. J. Petitfourt, B.A., F.C.P., Mr. J. P. Slingsby Roberts, Dr. E. McKellar, Deputy Surgeon General, J.P., Mr. A. G. Henriques, J.P., and Dr. W. J. Treutler.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. J. W. Nias and Mr. S. Cowell.”

It was proposed by Mr. F. PAYNE, seconded by Mr. J. H. GILKES, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year :—*President*: Mr. W. C. Wallis ; *Ordinary Members of Council*: Mr. W. W. Mitchell, Mr. E. Payne, M.A., Mr. J. Lewis, F.S.A., C.E., Mr. F. R. Richardson, Dr. K. J. Ryle, Dr. E. Hobhouse : *Honorary Treasurer*: Mr. E. A. T. Breed ; *Honorary Librarian*: Mr. H. Davey, Jun. ; *Honorary Curators*: Mr. H. S. Toms and Mr. T. Hilton ; *Honorary Secretaries*: Mr. Edward Alloway Pankhurst, 3, Clifton Road, and Mr. J. Colbatch Clark, 64, Middle Street ; *Assistant Honorary Secretary*: Mr. H. Cane.”

It was proposed by Mr. J. W. NIAS, seconded by Mr. J. H. GILKES, and resolved—

“That the best thanks of the Society be given to Mr. W. Clarkson Wallis for his attention to the interests of the Society as its President during the past year.”

It was proposed by Mr. T. HILTON, seconded by Mr. D. E. CAUSH, and resolved—

“That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curator, the Honorary Auditor, and the Honorary Secretaries, for their services during the past year.”

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WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

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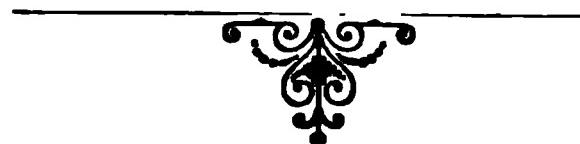
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Dec. 2, 1902
1901

BRIGHTON AND HOVE

**Natural History & Philosophical
Society.**

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

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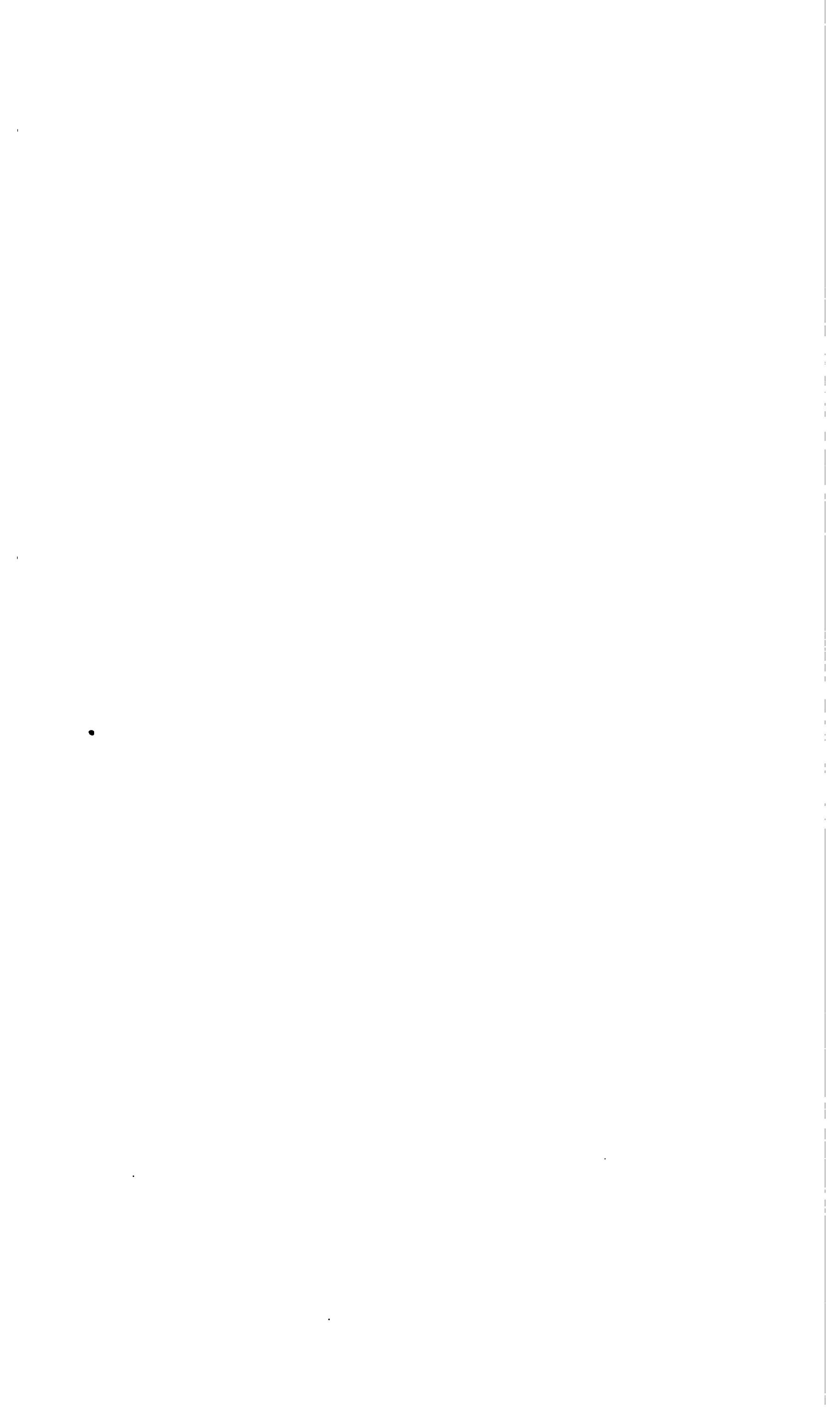
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SESSION 1901—1902.

THURSDAY, OCTOBER 17TH, 1901.

Excavating in Egypt and its Results,

BY

PROFESSOR FLINDERS PETRIE, F.R.S., &c.

THE Lecturer commenced by pointing out to his hearers the immense difference between the Egypt of the present, which consists of a great canyon, going down in parts 1,500 feet below the level of the dry, elevated plateau through which it cuts, and the Egypt of ancient times, in which the plateau was green and well-watered by rains and by numerous streams, running down into that Nile which to-day is a sluggish river of brown, muddy water, but which then was a lordly stream, with a level 80 feet above the point to which it has shrunk at present. The Egypt that the modern tourist sees is generally little but the banks of the Nile and the immediate vicinity. The Egypt where he carries on his persevering researches is the great dry plateau above, where, in the beds of now empty water-courses, and in the sides of the rocks, and buried under the accumulation of millenniums of sand and rubbish, lie the relics of the remotest human races of which we have any definite knowledge to-day. To this bare sun-baked plateau no one goes now but the excavator and the archæologist, with their trained bands of native workmen. There is no life, of men or of animals, unless it be a few birds who fly thither to prey upon the insects that the wind sweeps up from the Nile basin. Yet everything in this dried-up land testifies to the large amount of rainfall it once enjoyed, when men lived there long before historic time began. It is impossible to walk a quarter of a mile, said Professor Petrie, without coming across some flint that has been worked by man, washed down in the gravel of the long dry beds of streams.

The archæologist in Egypt has to deal with continuous written history handed down from an antiquity as remote as 5,000 B.C., while back over even that dim chasm of ages there is a further period of about 2,000 years, of which we have, indeed, no written relics, but which has left numerous traces, which

can be consecutively classified, in the shape of pottery, flints, and tombs,—a period as remote from the classical ages as the Ice Age and the Cave Men of Europe are from our own time. Fragments of mummies of these far-off ages have come down to us,—not straightly laid and bound as in the dynasties of historic Egypt, but crouched up in their rude tombs in the sides of rocks. Such mummies had nothing but skins thrown over them, while in one case a little copper band was found, for fastening together the skins, and this is the earliest use of metal that is known. From these ancient sepulchres have been recovered flints, ivory rings and spoons, figures of hippopotami, and mace-heads for fighting, with sharp-edged disks that, as the Professor said, could not help hitting something, as there was no way for the edge to turn. The graves where these relics are found have nearly always been already plundered for valuables long ago, and it is very seldom they are found untouched.

These pre-historic Egyptians were remarkably skilful in their handiwork and the use of their materials, and the samples of their craft that have been recovered show in many cases a delicacy of touch quite equal to, if not greater than, the skill of a Sheffield file cutter of to-day. The Professor threw upon the screen pictures of flint knives, beautifully rippled and flaked purely for ornament. These knives, he said, which were made entirely by hand, were often a foot long, and no more than an eighth of an inch in thickness. Such work is unequalled in any other country. Further evidence of a high state of technical efficiency and culture was provided by specimens of ornamented ivory spoons, with handles carved with animals, by bracelets of flint, ground down to the thickness of a straw, carved ivory hairpins, and by some wonderfully-worked hardstone vases, entirely done by hand and eye, yet so perfect in form that the most careful examination can rarely detect a fault. "We have, altogether, opened four to five thousand graves of pre-historic times in the past five or six years," said the lecturer. "We have recorded everything that has been found, and catalogued each article, and we could put back into its exact position everything that has been discovered. We have an exact record of each object." One curious kind of object found is disks of various sizes, carved with the figure of serpents, and perforated at the top, evidently meant for hanging on the person or the wall of a house. The Professor reminded his audience that in historic Egyptian times we have the guardian serpent of the temples, while even at the present day an Egyptian native will not disturb a serpent beside his house. Another interesting find was made in the grave of a child. Here were found nine little stone knobs and four big stone marbles, and with them three small stone sticks of such a shape that a sort of little gateway could be made from them,—

evidently a game of ninepins. In Norfolk to-day, said Professor Petrie, they still play skittles by bowling through an arch, so that the game can be traced back to the respectable antiquity of something like eight thousand years.

The audience were much interested in the lecturer's explanation of the system by which the comparative dates, though not, of course, the actual dates, of these ancient relics could be approximately determined. Certain classes of pottery and other articles were always found together, and the problem resolved itself into dividing them in sections, and gradually sorting out by statistical methods. The last section was found to correspond very closely with the objects found belonging to the earliest historic times. The pre-historic Egyptians, said the lecturer, were evidently closely allied to the peoples living in Syria and Lybia. There was no practical difference between them, and the earliest pottery of the Egyptians is almost exactly like that of the Kabyles of the present day.

About 4,800 to 5,000 b.c. the historic times begin, when an entirely new race of people came in and founded the First Egyptian Dynasty. The Professor showed pictures of various utensils of this time, whereon, easily recognizable, were carved such animals as the giraffe, lion, leopard, ibex, and others, which have for long ages been extinct in the land. Another instance of the wonderful handiwork of the old Egyptian craftsmen was a circular pot of syenite, two feet across, yet so thin (about a quarter of an inch) that it could easily be lifted with one hand. Continuous history begins at 4,800 b.c., with a record of ten kings before that, which brings us to about 5,000 b.c. From what we know, the probability is that the very earliest records have only undergone a few copyings.

On the broken forearm of a Queen of the First Dynasty, who had been dust for millenniums, his men had found a beautiful group of four bracelets, of alternate beads of turquoise and gold, threaded with ball beads. Every piece was numbered in order, and the Professor said that these jewels showed the highest technical perfection in the art of soldering. Each bracelet was entirely separate in design, and every piece was made for the place it had to occupy. "A far better idea of what jewellery should be than any we have at the present day," commented the Professor. Gold wire and lapis lazuli are also found in the jewellery. In the course of his excavations, the Professor found examples of concentric brick arches dating back beyond the Pyramids to about 4,200 b.c., thus taking back the history of the arch many centuries earlier than anything found hitherto. He also found the oldest metal sculpture in the world, dating about 3,500 b.c., in some small statues of the Sixth Dynasty, all beaten out in copper, yet as free and life-like in portraiture as if worked in clay.

About 1,400 B.C., a wonderful King, son of a Mesopotamian Princess, ruled the land of the Pharaohs. He tried to "reform everything," which could not be done in a generation in any country, more particularly in the East. He temporarily wiped out the worship of the old Egyptian gods, and established the worship of the Energy of the Sun,—a magnificent conception, and one which, said the Professor, people could not even to-day, as Nature worshippers, exceed the justice of. He also tried to reform the art of the country, and encouraged Mycenean artists and realism and naturalness in art, and tried in every way to change the whole of the nation's ideas. Such a change could not last. He died young, and every monument of his was thrown down, and every inscription erased. Yet the fact that the man could arise with such different ideas was "one of the most astonishing phenomena in the whole history of thought." The Professor had been so fortunate as to find a plaster cast of the dead face of this remarkable King, left by the sculptors who made his funeral monuments. The face was noticeable for the thoughtful expression it conveyed. A number of interesting specimens of the art work of this reign were shown, all of them remarkable for their fidelity to Nature. Some, indeed, such as sketches on broken potsherds at the King's Art School, might have been done by young artists of to-day. A fresco of this reign showed the earliest specimen of shaded drawing. After this date the Egyptians again reverted to the conventional in art.

Among the pictures thrown on the screen was one of a black granite slab, dating from about 1,400 B.C., in which occurs the first mention of the Israelites,—a mention four or five centuries older than any on the Assyrian monuments. It is not very lucid, and simply records the enigmatical statement that "the people of Israel's spoil was left without seed."

Another thing the Professor showed was a group of the oldest iron tools of which we know. They were part of the stock-in-trade of an Assyrian armourer in Egypt about 670 B.C., and the chisels, saws, files, and rasp showed that the contents of our carpenters' shops have moved very little in 2,000 years.

Finally, Professor Flinders Petrie told his audience some interesting details about the 80 trained Egyptian excavators who were ready to follow him to any part of the country for his work. He remarked that he got the best work from lads between 14 and 18, and that often these would do twice as much an ordinary English navvy.

The lecture was illustrated throughout with a series of admirable lantern slides.

THURSDAY, NOVEMBER 14TH.

Polar Problems—Arctic and Antarctic,

BY

MR. MILLER CHRISTY, F.G.S.,

With Lantern Illustrations.

FROM the old-time voyages of plucky Martin Frobisher, Columbus, and Magellan, through the long tale of daring captains such as Hudson, Ross, Franklin, Davis, who have dotted the realms of eternal ice with the record of their deeds, and have left,—many of them,—their frozen corpses to wait amid those awful solitudes until the crack of doom, the lecturer came to speak of our modern giant, Nansen, and his record voyage within 227 miles of the North Pole without the loss of a single man, and to the still later exploit of the Duke of the Abruzzi's sea-captain, who holds for the present the world's championship by his approach of yet another 20 miles nearer to the coveted spot. By the aid of a number of interesting old maps, Mr. Christy was able to show his audience very clearly how, when men had as yet no notion of the existence of the American Continent, and thought the earth was smaller than we know it to be, minds of explorers were set on reaching the eastern shores of Asia by sailing west across the Atlantic, and how this idea prompted Columbus in undertaking his famous voyage. To the day of his death, he said, Columbus had probably no notion that the land he had come upon was other than the outlying coasts of Cepango (Japan), Cathay, or India. From this idea, of course, sprang the name West Indies as applied to the great islands now called by that denomination. When the mistake was discovered, the enormous extent of the new territory was not yet known, and attempt after attempt was made to round the northern coasts of America in order to continue the journey. It was with the same view of getting round the obstructing land that Magellan sailed south, and, having brought his brave little vessel through the glacier-bordered straits that bear his name, emerged among the monstrous billows that make that part of the South Pacific a terror to navigators of to-day. At the other extremity of the American Continent the persistent attempts to find a North-West passage led to discoveries and deeds of heroism too numerous to mention. Among the discoveries was that of

the North Magnetic Pole. One valiant explorer was found, long after his death, sitting hard frozen in the cabin of his ice-bound ship, his fingers still grasping the pen with which he wrote his last message,—a dramatic figure for the imagination to fasten upon. Though the North-West passage has been discovered at last, "through peril, toil, and pain," their lives not the man who has ever passed by it from ocean to ocean, and the dream of the Passage as a roadway for the wealth of the East has long faded away. The race for the Poles has, of course, no material ends to gain, but Science wants to know many secrets, meteorological, geological, and biological, which mother earth still hides under her polar ice-caps. In the Antarctic, navigators have yet to discover the magnetic curves, without a knowledge of which safe navigation in those regions is impossible. Mr Christy spoke of the vast ice cliffs, 200 feet in height, which render landing on the supposed Antarctic Continent a practical impossibility, and he complained of the slackness of the British Government in subsidising scientific expeditions for Polar discovery. Yet the story he had to tell was full of the names of bold British sailors of the past, who, more than those of any other nation, had brought honour to their country by their discoveries. The lecture was illustrated by lantern slides.

WEDNESDAY, DECEMBER 11TH.

Parasites—Vegetable and Animal,

BY

MR. D. E. CAUSH, L.D.S.,

With Lantern Illustrations.

WEDNESDAY, JANUARY 15TH, 1902.

**An Evening for Exhibition of
Specimens.**

A Short Paper was also read by

MR. E. ALLOWAY PANKHURST

ON

Some Optical Illusions,

With Illustrations.

THURSDAY, FEBRUARY 20TH, 1902.

British Vegetable Galls,

BY

MR. EDWARD T. CONNOLD, F.E.S.,

With Lantern Illustrations.

GALL is from the Latin *galla*, and is used to signify the excrescences or unnatural growths of vegetable substances which make their appearance in Spring, Summer, and Autumn as deformities on various parts of many trees, shrubs, and plants.

Early writers on the subject of gall growths did not seem to have been able to determine how the gall fly contrived to produce the galls, each of which enclosed an egg. Some thought the grub itself caused the growth by eating, when nearly hatched through the cuticle of the leaf, and remained until the juices flowing from the wound hardened around it. Others supposed the eggs were deposited in the ground and being drawn up with the sap were carried throughout the tree until, having reached a certain point, its course was arrested and the formation of gall structure then began; and until some few years ago it remained more or less a mystery. Rennie, writing in 1845, "was aware of the fundamental fact that the mother gall fly makes a hole in the plant for the purpose of depositing her eggs," but he does not appear to have penetrated the mystery of the development of their growth.

It may now safely be said that a vegetable-gall growth is in general an abnormal growth of plant tissue, caused by the presence of one or more larvæ which have emerged from an egg or eggs that have been deposited in a perforation made by the parent insect in the roots, bark, and leaves of various trees, shrubs, and plants, the vegetable cells which accumulate around the larvæ providing them with nourishment and shelter.

The flowers, leaves, buds, shoots, branches, bark, stem, and even the roots of a large number of plants, shrubs, and trees are affected and attacked by various beetles, gall-wasps, saw-flies, gnats, moths, aphides, mites, and wormlets. The productions caused by this little army of invaders vary in size from very minute specks to swellings which attain to the size of an ordinary fist, the colours and shapes being equally as variable.

The shapes are most fantastic. Some are rough and gnarled, while others are smooth and soft. Some are so hard that it is

with difficulty that a pocket knife can cut them, while in contrast to these others can be easily compressed within the hand. One kind, which grows at the end of an oak bough on the catkins and young leaves, resembles bunches of red currants,—a tempting morsel on a hot May day,—while another kind away up amongst the top branches of a birch tree resembles a rook's nest. One kind assumes the form of a hop-strobile or a miniature artichoke, and is named accordingly. Two others resemble fruit, one taking the shape and appearance of an apple, the other exactly like a cherry minus the strig; another is like a small pea covered with downy hairs, while another kind reminds us of a number of percussion caps neatly arranged on the bark of a small oak bough. Further examples might be given, but these kinds arrest our attention most speedily.

Two of the most beautiful as regards wealth of colouring are the cherry gall on the oak, and the bedeguar gall on the wild rose, both of which, where touched by the sun's rays, turn a bright red.

The predominant colour, however, is green, very delicate shades of which may be seen at various stages in the growth of the galls; in fact, as may be supposed from the positions they occupy, they are all more or less green in colour, changing only as they approach or attain maturity. The common oak marble may be used as an instance. When growing in June it is a golden yellow if it be in the shade, but green if more exposed to the action of light. By September, however, it has changed to brown, becoming darker as winter draws near.

This is equally applicable to another species, *i.e.*, green at first, brown at last.

One of the most noticeable, and certainly the prettiest of the galls on the sallow trees, is the

Rosette Gall.

This gall is caused by the larvæ of a small two-winged fly called *Cecidomyia rosaria*. The fly, according to Theobald, is rather pretty, the general appearance being dusky black with silvery hairs, the wings grey and iridescent, and the antennæ as long as the body. The cluster of withered leaves at the end of the boughs of the willow tree bear a very close resemblance to a rosette, and hence its name. It is a very pretty form of gall, the appearance being most uncommon. No doubt it is frequently regarded as a mere cluster of withered leaves. Each larva inhabits a separate gall, and they undergo all the changes within the rosette. It is an example of the monothalamous group.

They may be seen at best during the months of March or April, depending upon the climatic conditions of the spring in

causing the sallows to throw out foliage early or late, and before the new leaves are fully developed.

These galls are of a woody nature, and appear near the end of the boughs and twigs of some four or five species of salix, and are found during April or May.

The Bulbous Gall.

The swelling takes place very rapidly, and assumes a more or less bulbous shape, having a smooth surface, except where the outer skin of the twig has been unable to compete with the growth of the gall ; the outline is then very uneven and ragged.

One noticeable feature of this gall is that although the growth is of such an enormous size in comparison with the twig on which it appears, the circumference of the twig is the same just beyond the gall swelling as it was before it reached the gall ; in fact, the deformity produced by this growth rises so abruptly from the surface of the twig and returns to it in a like manner, that it bears a striking resemblance to the kernel of a cracknut, with a little brown stick passed through it from base to apex.

If one of these gall be cut open, there will be found a considerable number of oblong cavities wherein lie the larvæ. The cells are arranged in a very irregular manner, some near the centre, others close to the exterior walls of the gall, and in such close proximity that one grub often eats into the domain of its nearest neighbour. The larvæ are rather pretty in colour. The body is more or less cylindrical in shape, divided into 13 or 14 segments, and, when fully grown, not quite an eighth of an inch long. The head is furnished with a pair of powerful black jaws. They do not appear to have any terminal outlet of the alimentary canal, therefore the cell is always quite clean.

As many as fifteen to twenty larvæ inhabit an average size gall growth, each one having a separate cell. They undergo their transformations in the gall, the flies issuing forth during the month of June, leaving a round hole on the surface of the gall, through which it has made its escape. This gall is one of the polythalamous species.

The common bramble furnishes us with the next example of gall growth. It is produced by the puncture of a little fly called

Lasioptera Rubi.

The larvæ are much the same kind as those of the genus we have just considered, resembling them not only in colour but also in size and shape, and likewise in attacking plants in much the same way.

The several species of wild rose, whose beautiful blossoms adorn the highways and hedges, are subject to the attack of three or four gall-producing wasps.

The most familiar, perhaps, is that called

The Bedeguar Gall,

which is produced by the energies of a very tiny and most brilliantly coloured gall-wasp, named *Rhodites Rosæ*. The word Bedeguar is from the French, the exact meaning of which I have yet to learn. This gall is more or less familiar to all who observe nature while walking in the country during the summer months. Occasionally, on a hedgerow, may be seen a long runner of a wild rose bush towering high above all the surrounding foliage, and upon it is the gall. This is not the only situation in which they are found, but it is a typical one.

When viewed from a short distance it has some resemblance to a reddish brown tuft of moss, of a globular shape. Variation in size is considerable, but they seldom exceed six inches in circumference. Upon close inspection, we find it composed of a mass of fibrous bristles, which are branched from their base to their point. One fibre of about an inch and a half long will throw off as many as 30 or 40 of these branchlets.

In common with many other varieties, it is the abode of numerous larvæ, and is a perfect illustration of the polythalamous division ; as many as fifty larvæ may be found in one cluster. Each larva inhabits a separate cell. The cells, or woody tubercles, as they are technically termed, are of various sizes, small ones being about the size of a little lead shot, others ten times larger. All the tubercles are fused together more or less strongly ; some will fall apart with a mere touch, while others require the use of a knife to separate them. The walls of the cells are thicker in the small ones than in the larger ones, some of which may be crushed with pressure by the finger and thumb, whereas the smaller ones can only be opened with difficulty.

Mingled with the other foliage of a hedgerow there may often be seen the leaves of the common maple. The attention is frequently arrested by the bright red appearance of the upper side of the leaves, rendered more conspicuous because of the sombre colour of the underside, as well as the greener colour of surrounding leaves. After a shower of rain, when the sun shines on them, they are very brilliant and attractive ; some of the leaves are entirely coloured, others only partly.

A careful examination of a leaf will show that the redness of the upper surface is due to a number of small swellings, which take the form of pimples, in size about that of the head of a small pin.

These tiny semi-globular elevations cause the leaf to appear as though it had been sprinkled with some kind of tiny dark red seed. When once these leaves have been examined they can be recognised again without difficulty. The underside of the leaf presents a striking contrast to the upperside ; it is of a very pale green, almost bordering on a yellowish colour. With the aid of a tolerably powerful magnifying glass it will be seen that there are numbers of minute pits, the mouths of which are slightly swollen above the plane of the leaf. These depressions exactly correspond to the pimples on the other side. A few of the pimples develop on the underside, in which case the opening of the pit is on the upper side of the leaf.

The leaves do not appear to be diminished in area from their normal size, because of the growth of these galls, nor are they contorted in shape ; indeed, their appearance is enhanced rather than otherwise. These swellings are produced by a gall mite.

The mischief which these insects do is very considerable when compared with their minute size. They are seldom observed moving about during the day, and it is still a matter of speculation as to how they spread themselves so easily all over the buds of a tree and along a hedge row, seeing they are destitute of wings, and do not jump. Being semi-transparent in colour and of a very restless nature, it is most difficult to study them microscopically when alive, and when dead they become flaccid, whereby increasing the difficulty of a correct delineation. They are very minute ; several hundreds may be found inhabiting one ordinary size bud of a currant bush, and considerable numbers in each swollen gall on the leaves.

Time has not allowed a review of such interesting topics as the life history and delineations of the insects which cause all these growths, the methods these insects employ in depositing the eggs, and the way in which the various structures are built up until they form the perfect gall ; as also the phenomena of parthenogenesis, and the alternating generations of the species. On all these points they furnish unique illustrations.

The object of this paper has been, firstly, by describing the shapes, appearances, and the usual positions some of the most common and familiar kinds of vegetable galls occupy, to enable you, when collecting, easily to recognise them ; and secondly, in so doing to create such an interest in them as will lead to thoughtful and patient study, a study which would be materially helped by collecting, preserving, and mounting as many examples as possible, and I trust that within the past hour the first has been attained, and during the coming year the second will result in the acquirement of a new pleasure to many who have been most kind and patient listeners this evening.

TUESDAY, MARCH 4TH.

Insect Architects and Engineers,

BY

MR. FRED ENOCK, F.G.S., &c.,

IN

MUSIC ROOM, ROYAL PAVILION.

FEW men could keep a roomful of Brighton people interested for two hours, listening to descriptions of just two varieties of insects. For a triumph like this Mr. Enock owes much to his really wonderful illustrations. With loving care for the minutest detail, he has drawn his subjects from life under the microscope, in their natural colours, and has perfected a series of lantern slides illustrative of insect life which must be almost, if not entirely, unique. In many cases, by most ingenious mechanical processes, he so manipulates the slides as to show the actual movements of the insect of which he is treating. It was of two insects, the leaf-cutter bee and the tiger beetle, that Mr. Enock set himself to talk, taking the former as a specimen of the insect architect, and the latter as an insect engineer. The leaf-cutter bee, whose Latin family name is Hymenoptera, receives its English name from its way of walking off with circular or oval slices of the leaves of various plants,—with a preference for Marshal Niel roses,—to make cells withal. He, or rather she, burrows a little tunnel in sand or any other suitable soft substance, and with the bits of pilfered leaves builds up in a wonderful way first one cell and then another, filling each cell with honey as it is completed, and laying one egg, so that the grub, when hatched, can feed upon the honey until it develops to the chrysalis stage, and thence to the bee. The whole history of the leaf-cutter bee's life Mr. Enock showed by his wonderful slides, from the act of cutting off the pieces of leaf, to the final exit of the young bee from its tunnel to the open air. Mr. Enock waxed enthusiastic over the bee's delicate antennæ, in which are situated its nerves of smell, hearing, and touch, and over its simple and compound eyes, while he grew fairly ecstatic on the subject of its hair. Showing a portrait of a male bee with its tongue out, he said it might be a satisfaction to some of his audience to know that the tongue of the male bee was longer than that of the female, but on the other hand the

female was compensated by possessing a far stronger jaw. Then, by one of his ingenious contrivances, he showed the bee's jaws working. In case any of his audience should be troubled by having their rose trees used too extensively as a quarry by the leaf-cutter bee, Mr. Enock gave the useful "tip" that all they had to do to protect the trees was to plant a border of six inches of "golden feather," which this bee will on no account cross. So intently has Mr. Enock studied the bee that he assured his audience he could tell the hum of one kind of bee from another, and he explained how, in one instance, he was successful in catching a rare kind of bee through having his attention arrested by the note of its hum, which he had not heard before.

The life history of the tiger beetle (family Coleoptera), of which some more wonderful illustrations followed, took Mr. Enock fifteen years to find out. He explained it to his audience in about an hour. One of the cleverest of his mechanical adjustments of slides showed the tiger beetle springing at its prey, and dragging it down into its hole.

Mr. Enock was careful to impress on his audience that anyone with perseverance and ordinary intelligence can watch for themselves the life-work of the wonderful little creatures he had been speaking of. Each year he felt himself more impressed with our "miserable ignorance" of insect life. In museums we had thousands of specimens of insects stored, but naturalists knew the life history of very few indeed.

THURSDAY, APRIL 10TH.

The Zones of the Chalk near Brighton,

WITH AN

**Introductory Sketch of the Existing Zones of Life
in Britain,**

BY

MR. WILLIAM McPHERSON, F.G.S.

IN order to make perfectly clear what is meant by the terms I have used, "Zones of Life," I shall begin with an example of the application of the term to existing conditions of life,—Animal and Plants. This will enable you better to understand the significance of the zones in the chalk, to the determination of which I have devoted the last four winter and early spring months.

The term Zone, as used in this Paper, is an arbitrary Horizon of Life. They more or less overlap each other, and the animal or plant chosen to represent the zone is one that has a small vertical range; and where they are most prolific, they encroach upon the zones above and under, but in diminished numbers.

I have selected the game birds and animals of Britain and their characteristic food plants, as they represent very distinct and well-defined zones, from the highest mountains down to the sea level. Latitude in Britain affects the zones; for example, the red deer is found in Inverness-shire at an elevation of 1,200ft.; in the Island of Lewis in the outer Hebrides it comes down to 200ft. Everywhere we find an adaption to their surroundings, in regard to altitude, latitude, and temperature. Moisture and cold play important parts in the distribution of life. Moisture in temperate latitudes, with its increase of vegetable food, where the monthly rainfall is fairly equally distributed, produces a greater number and variety of genera and species of animal life than is found in warmer climates with an irregular rainfall. Beginning with the highest zone of life in Britain, that of white hare and ptarmigan. The white hare (*Lepus albus*) inhabits the upper parts of the mountains of central Scotland. It was formerly found in Cumberland and Westmoreland, but is now extinct in

England ; it is not present in the islands of the outer Hebrides or in Orkney and Shetland ; the vegetation on these mountains is scanty, the surface is full of large grey boulders. This animal is a beautiful illustration of adaptation of its colour to the surroundings. The summer fur is of a dull grey colour, resembling the boulders ; when the winter snows are on the ground the fur changes to a pure white. The ptarmigan (*Tetrao lagopus*) is now found only in a few mountains of central Scotland, and, like the white hare, is extinct in England. The summer plumage is dull grey, corresponding with the boulders in summer, becoming with the snows nearly pure white. When disturbed it has a low flight, bobbing about the boulders. I refer to the summer flight (this was observed on Mount Schiehallion in Perthshire, Anglicé, "Mountain of storms"). The white hare has a wider vertical range than the ptarmigan, but the geographical range is more similar. Like the white hare it is not found in the Western Hebrides or Orkney and Shetland. It is difficult to account for this absence, for some of the mountains of the Islands of Skye and Shetland are similar to those which it frequents in Scotland, and they are much nearer their chief habitat, Norway and Iceland. It may have been caused by the islands remaining longer glaciated ; this is more probable by the absence of other forms of life—for example, frogs, &c.

The ptarmigan is found in North America, slightly different from the Scandinavian variety. The latter is the species abundantly exhibited in the shop windows in Brighton, and is rather smaller than the Scottish variety. The food of the white hare is represented on the diagram by *Poa alpina*. They feed mainly on the tender shoots and seeds,—the flowering plants, *Saxifraga nivalis* and *Silene acaulis*,—and all the representatives of this zone are entirely of an Arctic origin, survivals of the close of the Glacial Age in Britain.

The next zone on the diagram, that of the red deer (*Cervus elephas*) and the red grouse (*Tetrao scoticus*), is also of an Arctic character, though not exclusively so, as in the zone above. The red deer was formerly abundant in England and Ireland in a wild state, it now only survives under the protection of man. It is the only survivor of a numerous species that inhabited the United Kingdom and Ireland (all destroyed, with this exception, by the approach of the Glacial Age). Their fossil remains, mainly teeth, are numerous, and have been found at the Black Rock, Brighton, along with the reindeer. They are protected in Scotland and in Exmoor, Devonshire, for sport. One forest in Scotland was leased for £8,000 per annum, but the sport is only for six weeks. The term deer forest is misleading ; the word is used in the old Saxon meaning, as an enclosed place, for there is scarcely a tree in all their habitat.

Land Zones Existing.

ELEVATION.	ANIMALS.	BIRDS.	PLANTS.
4,000' to 1,000'	White Hare.	Ptarmigan.	<i>Saxifraga nivalis</i> , <i>Poa alpina</i> , and <i>Silene acaulis</i> .
2,200' to sea level.	Red Deer.	Red Grouse.	<i>Calluna vulgaris</i> and <i>Erica cinerea</i> .
1,000' to sea level.	Brown Hare.	Black Grouse.	<i>Agrostis canina</i> .
800' to sea level.	Rabbit.	Partridge.	Partridge—Cereals and Insects. Rabbit—Vegetables and Grasses.
300' to sea level.	Fallow Deer.	Pheasant.	Deer—Cultivated Grass. Pheasant—Cereals and Cultivated Roots.

Marine Zones Existing.

DEPTH.	INHABITANTS.	REMARKS.	LOCALITY.	RANGE.
Inter-tidal.	Barnacle. Limpet. Mussel. <i>Rissoa</i> . <i>Cerithium</i> . }		British Coasts.	
To 100'	Star Fish. Crab, Lobster. Flounder, Haddock. <i>Trochus</i> . } <i>Mactra</i> .	At maximum.	British Coasts.	
100' to 300'	Cod. Ling. <i>Pleurotomaria</i> .	{ 300' Limit of marine vegetation.	British Coasts.	0' to 700'
300' to 600'	Skate. Turbot. <i>Terebratulina caput serpentis</i> .	{ 600' Limit of sun's rays.	British Coasts. Hebrides.	0' to 800'
600' to 700'	<i>Beryx splendens</i> . Hake. <i>Terebratula wyvilli</i> . <i>Terebratulina caput serpentis</i> . } <i>Rhynchonella psittacea</i> .	2,000' 7,000' to 17,000' 0' to 6,500' 60' to 2,000'	Japan. Ireland. South Australia. Oban, N.B. Shetland.	600' to 2,500' 0' to 2,400'

The red grouse (*Tetrao scoticus*) frequents the upper plateaus of the Scotch, English, and Irish mountains ; it is most abundant in Scotland, less so in England, and comparatively scarce in Ireland. It rarely descends to cultivation, and when it does and feeds on cereals, the change of food produces disease, a species of pneumonia. The proper food of the red grouse is the tender young shoots of the plants mentioned in the diagram, *Calluna vulgaris* and *Erica cinerea*. The red deer and red grouse have a much wider geographical distribution in the British Islands than the zone above, they are both found in the islands of the Hebrides ; while the red deer is distributed throughout the Continent of Europe, the red grouse is entirely confined to the British Islands. Their presence in the outer islands is in remarkable contrast with the higher zone. The nearest ally to the red grouse is the willow grouse of Scandinavia, all inhabitants of treeless regions.

The food, *Calluna vulgaris* and *Erica cinerea*, is very widely distributed in the British Islands and throughout the Continent of Europe. I have no satisfactory explanation to offer for the restricted geographical area of the red grouse. It is a bird strong of flight, and perfectly capable of crossing the Channel or even to Norway. Glaciation may be the solution of the question, but it is confronted with many anomalies and difficulties. The red grouse is abundant in the Western district of the Island of Lewis, where the glaciation was relatively late, and clearly marked on every exposed rock ; also in Sutherland, two prolific habitats of the red grouse, thus very largely diminishing the value of the theory of glaciation for the restricted distribution of the upper zone, the white hare and ptarmigan. However applicable to the higher zone, it entirely fails in this to account for the distribution in the British Islands of the red deer and red grouse.

The next zone is the brown hare (*Lepus timidus*) and the black grouse (*Tetrao tetrix*). The black grouse, usually known to sportsmen as black game, frequents the hills above the tree line and the upper part of the tree line, just bordering the limits of cultivation. It occupies a well defined zone of the grasses under the *Calluna vulgaris* and *Erica cinerea*, mainly feeding on the young shoots and seeds of *Agrostis*. It is a larger and more powerful bird than the red grouse but inferior for sport. The brown hare has a wider range than the black grouse. The same difference in range is observed between the white hare and the ptarmigan. The narrower vertical range of the birds, with their superior power of locomotion, I think, can be explained by the quadruped's more omnivorous vegetable food.

The next zone, the rabbit (*Lepus cuniculus*) and the partridge (*Perdix cinerea*), do not go so high as the upper part of the zone above, but they overlap in the lower part. The partridge

is rarely found far from cultivated fields. Its food is cereals and seeds of the grasses bordering the cultivated fields ; it has a more restricted geographical distribution in Britain than the red grouse, not being found in the Western Hebrides or Orkney and Shetland. The rabbit has a similar range as the partridge, from the lower part of the black grouse zone down to the sea level. It is not found native in the outer Hebrides, but has been introduced in the Island of Lewis quite recently. The lowest zone, the fallow deer and the pheasant, is not a natural one, it represents a fauna imported and protected by man ; they are aliens, and could not survive in this climate unless protected. There is at present an interesting illustration of protected animals becoming confined to their habitat : in Scotland the large sheep farms, when let, contain a clause in the lease, that the incoming tenant takes over the sheep stock at a valuation, the arbitrators usually value the stock at ten to fifteen shillings per head above the current market price, because the sheep have become acclimatised and do not go beyond their zone, or limits of the farm. There are seldom any boundary fences, and new stock would wander across the boundary or zone of the farm. This question is at present much discussed in the Scottish newspapers.

Marine Zones Existing.

Having found the Terrestrial Zones of Life and Plants clearly defined and separated in their vertical range in Britain, we now come to the Inter-Tidal and Marine Zones. We here find the same adjustment to their surroundings as in the Terrestrial Zones. I have chosen depths to describe the zones, in preference to the seaweeds usually taken for this purpose. The seaweeds have distinct zones to a depth of 800ft., the limit of marine vegetation.

For the Inter-Tidal Zone all the examples mentioned in the diagram are found on the Brighton shores east of the Black Rock. They are found in descending order. They are to a certain extent amphibious ; nearly one half of the twenty-four hours they are covered by sea water, and again exposed to strong light and frequent showers of rain water. With the exception of the edible limpet (*Patella vulgata*), they select the darkest corners of the rocks. There are two species of limpets, the first named and a very much smaller and more compressed species, beautifully coloured and striated on the outside of the shell, and richly coloured inside. The barnacle and limpet come close up to high tide.

The mussel, *Rissoa*, and *Cerithium* do not come so near high tide mark. The latter adhere to seaweed and corallines. There is a very minute zoöid adhering to the latter in great abundance. It forms the principal food of the larger mollusca. The

numerous round cells found in the inter-tidal chalk are made by a boring bivalve (*Pholas dactylus*). It is abundant near low tide, and is nearly white and richly sculptured on the outside. It is edible, and greatly esteemed on the Mediterranean shores, where it commands a high price. The late Professor Leach highly praises it for fine flavour and delicacy when cooked.

Among the rarer molluscs are two species of *Chiton*. Rare on the chalk shores, they are more common on the northern coasts. All the above are inhabitants of temperate seas. The limpet is not found north of Scandinavia. The average winter temperature of the sea around the British coasts is from 40° to 45°. The inter-tidal mollusca are incapable of resisting severe frosts. The great frost of the winter 1854-55 destroyed the greater part of them from the South-West of England to the Moray Firth in Scotland. The next zone, 0ft. to 100ft., is inhabited by mollusca and fish that live only under sea water. There is only one species of star fish found in Brighton (*Asterias rubens*). It is fairly common in the late spring and summer at very low tide, or thrown on the beach by storms. The starfish, unlike the limpet and barnacle, is incapable of living out of its habitat,—sea water. Immersion in fresh water causes instantaneous death. The brittle star fish, which has the power of breaking its limbs, is preserved by putting it into fresh water. From the classic authors of Greece and Rome the star fish has had a bad name for burning, stinging and poisonous qualities. Sir Thomas Browne, of Norwich, in his "Vulgar Errors," does not disprove the popular error. Our star fish is perfectly harmless. The bad reputation survives in the local names, as "The Devil's Hand," "The Devil's Fingers." Science is a plant of slow growth in the popular mind.

The crab and lobster, flounder and haddock are well-known inhabitants of shallow water.

The molluscs *Trochus* and *Mactra* are found at a depth of from 50ft. to 100ft. After storms the shells are found on the beach.

The next zone is 100ft. to 300ft., the latter the limit of marine vegetation. The cod (*Gadus morhua*) is sparingly found in the Brighton sea. The cod is a rather widely distributed fish around the British coasts, most prolific on the northern areas. The ling (*Lota malva*) has a still more northern zone than the cod, and frequents deeper water. The cod and ling fishing is a large industry in the North of England and Scotland. The next zone, 300ft. to 600ft., is under the limit of marine vegetation; consequently, all the inhabitants are carnivorous. Light ceases to penetrate below this zone.* A decided change takes place in the size of the eyes of those fish that frequent the lower

part of this zone ; they are much larger. It has been suggested that the increased size is an adaptation to catch the faint rays of light that penetrate to that depth.

The next zone. The turbot (*Pleuronectes maximus*) and the skate (*Raia latus*), the representatives of this zone, are ground feeders, rarely coming to within 200ft. of the surface. The rays have a great geographical and vertical range. The *Terebratulina caput serpentis* has been found in the Hebrides of Scotland at a depth of 600ft. It has an enormous geographical and vertical range in the existing seas. The *Challenger* Expedition found it at a depth of 6,500ft. off the Japan Islands. The ranges correspond closely with that of the Rays. We shall find, when we come to describe the fossils of the chalk, that it has an equally wide distribution as a fossil.

The next zone, 600ft. to 1,700ft., is represented by *Beryx splendens*. This species has some affinity to the Beryx found as a fossil in the chalk. It frequents the seas off Madeira at about 600ft., and was found off the Japanese Islands by the *Challenger* Expedition at 6,500ft. This fish is a good illustration of the increase of the size of the eyes at 600ft.,—the limit of light. I here quote from Professor Edward Forbes and Mr. Godwin Austin. Writing about the Madeira Fish Market, they say :—

“ The spring is characterised by the common appearance of the splendid coloured Beryx in the streets, attracting notice no less by its hues of silver, scarlet, rose, and purple than by the extraordinary and opalescent or rather brassy lustre of its enormous eyes.”

The Hake (*Merluccius vulgaris*) is also a fish of very wide distribution, abundant in the deep waters of the British seas. It has been found at a depth of 2,500 feet. The family is very widely distributed. The Marine Zones are well defined and separated from each other ; the limit of vegetation is inhabited by its own species of vegetable-eating mollusca and the fish that feed upon them, thus limiting the fauna to a small vertical range. The geographical range is also limited by cold, as we found in the example of the limpet. The greater geographical and vertical range of the fish inhabiting the deeper waters of the sea is a result of the uniformity of the conditions of their habitat. The vast area of the Deep Sea has no violent changes of temperature to act as a barrier to their distribution, and the abundance of their food and power of locomotion enables them to inhabit this great ocean area—both geographical and vertical. I extract from the *Challenger* Reports the depth at which fish and mollusca have been found. The Deep Sea or abyssal fauna attains its most prolific development at a depth of from 8,600 feet to 7,200 feet. There is a great abundance of *Hexactinilid* sponges, stalked crinoids, and sea urchins allied to *Salenia*.

Cephalopoda are found to a depth of 12,000 feet; Echinoidea to 17,000 feet; the Crinoids to a depth of 17,000 feet; the Brachio-poda to 17,000 feet; the Gasteropoda, in very diminishing numbers and variety, to 15,000 feet. Fish are found at depths of 17,000 feet at twenty observation stations.

The lesson derived from the examination of the conditions of Life in the Marine Zones is the same as in the Terrestrial, adaptation to environment or extinction.

The Fossil Zones of the Chalk in Brighton and Neighbourhood.

From the consideration of the elementary and well-known zones of existing life, we now come to the less known zones of fossil life. The conditions are widely different in the fossil state. We now depart from the contemporaneous view, and have to examine the life history of genera and species, deposited in the chalk, at vast intervals of time, the greater part of them appeared for the first time, and became extinct with the close of the deposition of the chalk. I have endeavoured to show in the existing zones of contemporaneous life, an adjustment to their terrestrial and marine environments. The marine survey was over a wide area of the existing seas, and a smaller extent of land. The area of the cretaceous sea was very great. I shall be able later to exhibit a co-relation of fossils deposited in nearly similar conditions at a distance of 6,000 miles apart. The cretaceous sea was perhaps not inferior in area to the Atlantic or the Pacific Oceans,—certainly larger than the Mediterranean. The exact area is impossible to be ascertained; denudation has removed the evidence of its deposition over many parts of England, and nearly all of Scotland. Tertiary volcanoes have probably largely metamorphosed and destroyed the chalk in the Island of Mull and Scotland generally, where the remains of the cretaceous sea are isolated and scanty. The cretaceous sea, like the modern ocean, had its shores and depths, for it is a well-recognised opinion that, since the beginning of geological time, there has been a division of the globe into sea and land, and consequently there were various degrees of depths and currents, as we find in the present oceans. The chalk is largely composed of microscopic foraminifera and the more or less minute fragments of the shells of mollusca. The proportion varies greatly: generally, the deeper the water the more minute the fragments and the purer white the colour of the chalk. In interpreting the history of the Fossil Zones, we have not the same absolute proof of their position that we had in the Existing Zones; we have to rely largely on the palaeontological evidence, supported in a lesser degree by the lithological. The exposures of the chalk in Brighton and district are as complete as in any other County in

England, with the exception of Dorset. The only zone that is absent is the highest known in England,—*Belemnitella mucronata*; it is only found in Norfolk and Dorset, Hampshire and Wilts. Dorset is the only County in England that has all the zones of the chalk represented from the highest to the Chloritic Marl on the coast.

Zones of the Chalk.

UPPER CHALK—

- ZONE 1. *Belemnitella mucronata*.
- „ 2. *Actinocamax (Belemnitella) quadratus*.
- „ 3. *Marsupites*.
- „ 4. *Uintacrinus*.
- „ 5. *Micraster cor-anguinum*.
- „ 6. *Micraster cor-testudinarium*.

MIDDLE CHALK—

- ZONE 7. *Holaster planus*.
- „ 8. *Terebratulina gracilis*.
- „ 9. *Rhynchonella cuvieri*.

LOWER CHALK—

- ZONE 10. *Actinocamax (Belemnitella) plenus*.
- „ 11. *Ammonites rotomagensis* or *Holaster subglobosus*.
- „ 12. *Ammonites varians* or *Rhynchonella martini*.

The zones of the chalk represented on the Brighton Coast and inland to the base of the escarpment to the south of the Lewes plain—which is my limit of Brighton and district—include all the zones of the chalk from *Actinocamax (Belemnitella) quadratus* to the grey chalk, the lowest on the diagram. The zone represented on the diagram—*Holaster sub-globosus*—is the lowest zone found in the Brighton district. The upper and middle chalk, which we find to have been deposited in this neighbourhood, has been laid down in comparatively deep water. This is fairly well proved by the abundance of *Ventriculites*, sponges and the almost total absence of the *Gasteropoda*. This is characteristic of the deep waters of the existing seas and a good co-relation with the Cretaceous Sea. I may mention here that the *Challenger* Expedition found mollusca closely allied to the cretaceous species at a depth of from 10,000 to 17,000 feet. In the upper chalk Univalves are the rarest of fossils; with great depths in the existing seas they are equally rare. In the lower chalk they are more frequent, indicating a deposition in a shallower sea. The zones are represented by a fossil that has the most definitely restricted vertical range. As I explained in the existing zones of animal and plant life, the zones are the life histories of the species.

The zones on the diagram are those recommended by the Sub-Committee of the Geological Congress, 1888, for Zone No. 9 (*Rhynchonella curieri*) can be more readily recognised by Professor Barrois's zone of *Inoceramus labiatus*; it is much more abundant than the former, and, in small exposures, more readily found. The recognition of strata from their fossils was first announced in a small volume published by Mr. William Smith, Mineral Surveyor, Derby, entitled "Strata Identified by Organised Fossils." He gives the fossils of the upper chalk, and the illustrations occupy half a sheet. I have placed the volume on the table, and, alongside it, the volume of the Palaeontographical Society, where a single genus (*Spondylus*) is illustrated by sixty-four figures. This exhibits a very large increase in our knowledge, but, for field work, the illustrations in Smith's book are much superior,—clear and clean cut lines are well drawn.

Professor Barrois was the first to describe the zones of the chalk on the English and Irish coasts. His divisions and zones are generally accepted in this country. In England the latest and most exhaustive description of the zones of the white chalk of the English coasts is by Dr. Rowe, F.G.S., &c.,—diagrams by Mr. Sherborn (1900). The first part, Kent and Sussex, describes the coast sections from Newhaven to Brighton. To the field worker it is an invaluable guide. The accuracy and precision of description, and the clearness with which the zones are separated and explained, is delightful,—a classic work for the coast sections of the white chalk.

To Dr. Rowe I owe much. He directed me how to recognise the zones of the chalk by their fossils, and, for the last three years, by a large correspondence, notwithstanding the calls of a busy profession, has identified and described my specimens.

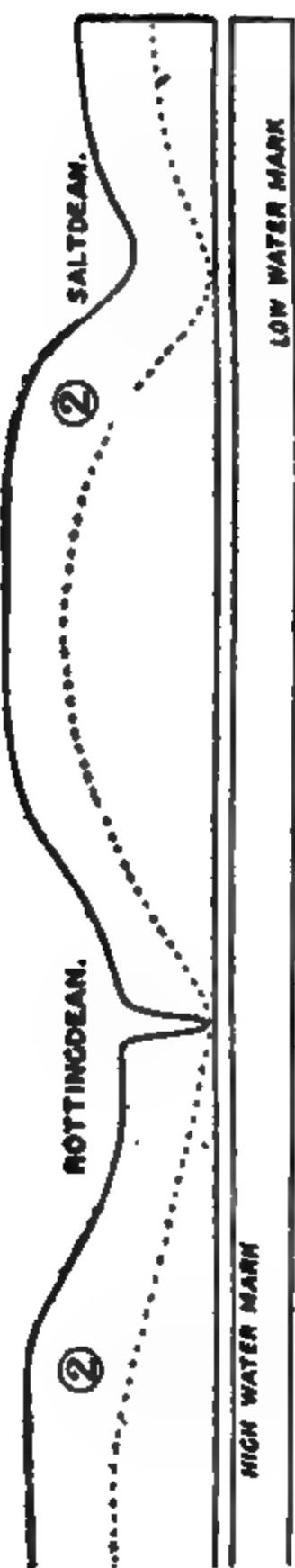
Zone 1.—*Belemnitella mucronata* is altogether absent in Sussex. I exhibit a specimen from Trimingham, Norfolk. This zone has only been found in the Counties of Norfolk, Hampshire, Wilts, and Dorset. I have searched for it between Newhaven and Preston Railway Station, without success, the only localities where it is likely to be found.

Zone 2, *Actinocamax* (*Belemnitella*) *quadratus*.—This zone is widely represented on the Brighton coast. It is found on the upper part of the cliffs from Newhaven to Saltdean Gap, where it comes down to the tide level, then running high in the cliffs to Rottingdean, where it again comes down to the shore, then runs high in the cliffs to the junction of the chalk with the Coombe Rock near Brighton. Inland it is found in road cuttings between Newhaven and Rottingdean, and in a small roadside quarry at East Hill, three-quarters of a mile north of Rottingdean. It is again exposed in Ovingdean quarry and near the Golf House in chalk thrown up in digging drains for houses

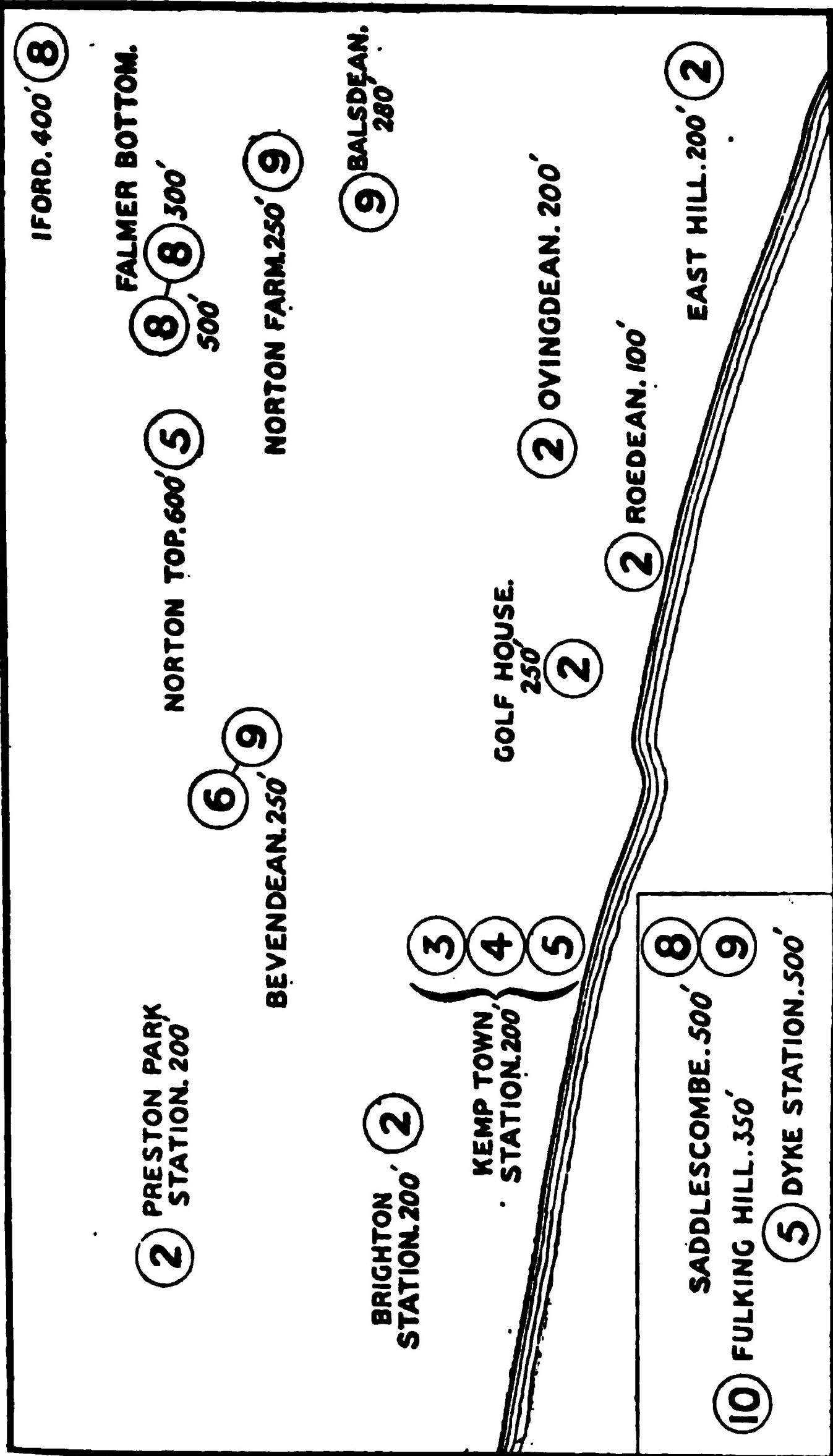
now building. Coming westwards, there is a considerable gap. It is not found in Kemp Town Railway Station quarry ; it reappears in the cuttings of the Brighton Railway Station, and runs along the Railway to Preston, and perhaps to Patcham,—the evidence of its presence at the latter place is, so far, inconclusive. The name-fossil is not common in any part of the zone ; it is found sparingly on the inter-tidal chalk from the Pumping Station to Newhaven, and in fallen blocks from Coombe Rock to Newhaven. There is a small urchin, *Cardiaster pillula*, restricted to the upper part of the zone ; it is a safe guide to the zone, and can be often found in small exposures when the Belemnite is absent. I have not found the Belemnite in any of the inland exposures. *Cardiaster pillula* is very abundant in East Hill quarry near Rottingdean. I found a block of flint that fell from the top of the cliff at the junction of the chalk and the Coombe Rock with fifty examples, many in fine condition. The half of the block is now in the Brighton Museum among the fossils illustrating the zones of this district. Another characteristic fossil of the zone is *Belemnitella granulatus*. It is of a granular texture, and found in the inter-tidal chalk of the west end of the *Marsupites* zone from Roedean Cottage to Rottingdean ; it is a rather rare fossil, as all the *Belemnitella* are on this coast. *Pecten cretosus* is found high up in the cliffs west of Rottingdean ; it is not common, and one of the most beautifully ornamented of the chalk fossils. *Spondylus spinosus* is very common throughout this zone and of large size, both in the chalk and flints. It attains its maximum size near the junction of the zone with *Marsupites* under Roedean Cottage. *Spondylus dutempleanus* is found rather sparingly throughout, is rare, in good condition, and more restricted to the upper part of the zone. *Echinocorys vulgaris*, popularly known as the Shepherd's Cap, is the most abundant fossil on this coast. It is of a smaller size than those found in the zone under. Sponges are abundant throughout, especially calcified forms, and *Ventriculites*, *Pharetrrospongia strahani* is fairly common in the lower part of the zone. A fine specimen is in the zonal illustrations. It can generally be found in the inter-tidal chalk between Rottingdean and the Pumping Station. There is another characteristic fossil, *Ostrea lateralis*, var. *striata*, from the upper part of the zone. It is small and the striations are rather faint. *Cardiaster pillula* and *Terebratulina striata* are found in Ovingdean quarry,—a fair exposure with few fossils. It has not been worked for many years.

The next zones 3 and 4 are not usually separated. I have divided them from the very well defined division into upper and lower horizons in the Kemp Town Railway Station quarry, *Marsupites* the upper and *Uintacrinus* the lower part.

Coast Section showing Zones.



Inland Zones.



The coast sections exhibit the same division, but not so clearly marked as it is in the fine vertical exposure of *Uintacrinus* in the quarry. *Marsupites testudinarius* was formerly described in text books under several specific names, derived from the smoothness or roughness of the ornamentation on the calyx plates. The smooth plates are generally found in the small specimens, and may be younger than the rougher ones. *Marsupites* has been described by a great living authority* as like to "Mahomet's coffin suspended between heaven and the earth, for it has no ancestors or successors." This zone is very well represented on the low cliffs and inter-tidal chalk near Roedean Cottage, and poorly, mainly in single plates, in Kemp Town Railway Quarry, as we there reach the base of the zone only. It has not yet been found in any other exposure in this district. I think it may yet be discovered in the railway cuttings between Brighton and the Dyke. This rare and beautiful fossil is formed of sixteen unjointed body plates, with five rows of unjointed arm ossicles. It was a free swimmer, and no perfect specimen has yet been found, a rare joy awaiting some future searcher. I have seen a few fair specimens in flint, and should not be surprised if it is found in that position. There is no better exposure for fine large examples than the low cliffs and inter-tidal chalk from Roedean Cottage, and four hundred yards eastward there I have found many beautiful specimens, but without the arm plates. I give the dimensions of two kindly made for me by Dr. F. A. Bather. They may be useful for the guidance of future collectors:—

No. 1.

Mm.

Height

45·2

Height

45·8

Greatest width... ...

46·5

Greatest width ...

40·6

Least width

34·4

Least width

37·3

Average width... ...

40·4

Average width ...

39·0

No. 2.

Mm.

Height

45·8

Greatest width ...

40·6

Least width

37·3

Average width ...

39·0

So far as is known at present, *Marsupites* is better represented in England than in any other part of the Cretaceous sea, and it is only found in a small vertical horizon in that sea. It has now a very small geographical range, being found only in fragments in France and in Algeria, and not in America, which is very surprising when we consider the large development in that country of the lower part of the zone *Uintacrinus*. There is little doubt it will yet be found in the United States, India, and Palestine.

Among the characteristic fossils of the zone are found *Echinocorys vulgaris*, of a helmet shape, hence the popular name of Shepherd's helmet. The zone can be fairly well recognised

* Dr. F. A. Bather.

by this fossil, and, equally so on the coast, by the presence of *Echinoconus conicus*. Whenever you find it you may be certain you are near *Marsupites*, at least, on the coast. *Lima hopperi* is found of a large and fine form, but, owing to the delicacy of the shell, difficult to separate from the matrix. *Spondylus spinosus* here attains its maximum size. They are quite common, with the spines well preserved, but are very fragile, and great care is required in cleaning. If the chalk is allowed to dry, the spines are more easily saved. *Ostrea uegmanniana* (D'Orbigny) was discovered, for the first time in England, in 1899, in this zone, by the writer. The original and finest block, for they are gregarious, is among the collection to illustrate this paper. It ranges from the *Uintacrinus* beds at the Black Rock to the base of the *Actinocamax* (*Belemnitella*) *quadratus* zone, near Rottingdean. The most likely place to find specimens is in the inter-tidal chalk, one hundred yards east of the Pumping Station. They are well known in the chalk of France and were found many years ago by Mr. Griffith and Dr. Rowe, but not identified by the Geological Survey, Jermyn Street. This zone has only one Ammonite, and a very remarkable one it is (*Ammonites leptophyllus*), popularly known as Landscapes, a good description of their sutures, and sometimes Carpet Slippers, which is not so appropriate. It goes from *Uintacrinus* to the middle of the *Actinocamax* zone beyond Rottingdean. There is a fair specimen at present exposed on the inter-tidal chalk near Roedean Cottage, 4 feet 3 inches in diameter, in circumference 12 feet 9 inches. They are quite common, but generally much worn. They are not found in France. This is an interesting fossil, the last species of the race, and it is curious how it should have become extinct on attaining this enormous size. There is no evidence from the chalk structure to exhibit any violent change in the condition of life to suddenly destroy this genus, which survived numerous and sudden changes throughout the Lias, passing above the Gault, in very different conditions to the chalk, in diminishing numbers, and finally disappears in the *Actinocamax* (*Bel.*) *quadratus* zone, long before the chalk deposits ceased to be laid down. There is a fine specimen in the British Museum, taken from the neighbourhood of Rottingdean. *Cyphosoma karnigi*, one of the beautiful fossils of the zone, is fairly common in fragments, but specimens in good condition are rare.

The lower part of the zone, marked No. 4 on the diagram, is the sub-zone of *Uintacrinus*. This fossil was a free swimming crinoid. The first specimens were collected by Professor Marsh in 1870, from the Uintah Mountain, hence the name. A fine block from Kansas in the British Museum, with perfect specimens, led to a search in this country, with the curious result that plates and ossicles were found in Dr.

Rowe's collection,—undescribed for twenty years. They were also found in the Willett collection in the Brighton Museum, described as *Marsupites*. In 1899, directed to search in the neighbourhood of the Black Rock, by Dr. Rowe and Mr Sherborn, I was successful in finding a few plates and ossicles on the inter-tidal chalk, the only exposure on the coast. They are not found beyond five hundred yards to the east of the steps at the Coombe Rock, where *Marsupites* begin to be sparingly found. Making an examination of the inland exposures this winter, I found an exposure of the zone of fifty feet in the Kemp Town Railway Station Quarry. It contains single plates and many ossicles, accompanied by many fragments of *Bourgeticrinus*. This is the only other exposure of *Uintacrinus* in the Brighton district and also the best. It can be traced from the base of the west side of the quarry, gradually rising until it joins the *Marsupites* beds at the top of the tunnel, a height of 85 feet. The base of the tunnel is the zone of *Micraster cor-anguinum*. This quarry is the only exposure of *Marsupites*, *Uintacrinus* and *Micraster cor-anguinum* that can be studied in situ in the inland exposures, as only a few connected plates of *Uintacrinus* have been found in Britain. I give some measurements and description from Professor Beecher* of perfect specimens found on a slab in Kansas. "Notwithstanding the considerable geographic range, the horizon appears to be nearly constant. The slab occupies 27 square feet of surface. In the area are calyces of 220 individuals. Occasionally a specimen measures 70^{mm} across the diameter. A flattened condition is about 60^{mm}. minimum specimen. The arm branches can seldom be traced more than 10mm from the calyx, though separate ones extend quite five times that distance from the surface. The presence of several small *Ostrea larva* tends to show that the water was of a moderate depth. Nearly all the specimens of *Uintacrinus*, as well as the limestone layers containing them, are of a light buff colour."

I have found *Ostrea larva* in the *Uintacrinus* beds at the Black Rock. It is now in the British Museum. This is the lowest zone that it has been yet found in England. This correlation of *Uintacrinus* and *Ostrea larva* from Western Kansas in America to Brighton, a distance of six thousand miles, gives an enormous area to the nearly contemporaneous deposits in the cretaceous sea. The absence of *Marsupites* in America may possibly have been caused by the land rising in America and sinking in England. With *Uintacrinus* is associated, at the Black Rock and Kemp Town quarry, two fossils of an equally restricted vertical range. *Actinocamax verus*, which is not

found above the *Uintacrinus* beds, is small, without an alveolar cavity. It is a rather rare fossil. The other, *Terebratulina roulei*, goes up to the base of the *Marsupites* beds. It is very small, and, like *Terebratulina gracilis*, rather gregarious. *Kingena lima* is found, but is rather a rare fossil in this zone. *Oreaster ocellata*, a very rare Asteroid, I found at the eastern end of the zone in the inter-tidal chalk near Roedean Cottage. There is here a bed of much crushed crinoids, and should be carefully examined for good specimens. The *Echinocorys vulgaris* of this zone are very characteristic. They are of great size compared with the zones above, and the upper surface is nearly flat in many specimens.

The discovery of *Uintacrinus* in Kemp Town Railway quarry was quite unexpected. The distance from the Black Rock is about a mile, and the elevation at the base 200 feet, and *Uintacrinus* rises in quarry to 250 feet; so that we have in that distance the horizon above the sea level raised 250 feet. The denudation between the Golf House and Kemp Town was narrow near the coast, for we find at the Brighton and Preston Railway Stations the highest zones of the Sussex chalk *Actinocamax (Bel.) quadratus*. At the end of the Paper, an attempt will be made to explain this gap and the extensive inland denudations. The next zone 5, *Micraster cor-anguinum*, is found at the base of the cliffs east of the Pumping Station. It overlaps a considerable part of the *Marsupites* beds above, and *Uintacrinus* under. It is well exposed at the base of both sides of the Kemp Town quarry. *Rhynchonella plicatilis* is common, but more abundant and of a larger size in the zone above. Good examples of *Terebratulina striata* are found here. This fossil is found in all the zones of the chalk and is found living at great depths in the present seas,—at 600 feet in the Hebrides and 7,000 feet off Japan. *Micraster cor-anguinum* is also found in the Railway cutting at Dyke Station,—an elevation of 500 feet. It is also found in a small hillside quarry at Norton Top,—elevation 600 feet. The zone in this district is everywhere poorly exposed.

Zone 6, *Micraster cor-testudinarium*.—This is a new discovery of the zone in this district. The only exposure, and it is a very slender one, is on the hill road, half a mile south of Balsdean Farm, towards Rottingdean. The exposure is so small that few examples have been found. One specimen has been described by Dr. Rowe as "an absolutely typical one." It will be found among the specimens illustrating the zone. A few associated fossils are *Terebratula carnea*, *Terebratula semi-globosa*, *Rhynchonella plicatilis*. *Epiaster gibbus* may belong to this zone, but it was not found in situ.

Zone 7.—*Holaster planus* (middle Chalk) is found at the top of Bevendean Pit, a small exposure one-sixth of a mile

north-east from Bevendean Farm. *Holaster placenta* is also found, and *Micraster precursor*. They may represent the junction with the next zone.

Zone 8.—*Terebratulina gracilis* is much more satisfactorily exposed than the last three zones. Hitherto unknown in this district, and found within three miles of Brighton, and at an elevation of 400 feet above the highest zone on the coast, the two principal exposures are at Saddlescombe Quarry, 500 feet above sea level, and at a place named Falmer Bottom on the 6in. map. The exposure at Falmer Bottom begins at the 450 level, on south side, and is found in chalk turned up by the plough, in an attempt to take in a few extra yards of the crest of the hill. I have proved the zone also by digging into the hill side, and found sixteen in an hour. At Saddlescombe the exposure is large, showing sixty feet of vertical chalk. The name-fossil is abundant with a few *Rhynchonella curieri*. It is found more sparingly in Bevendean, Iford, Balsdean, and Norton Pit, under Falmer Bottom, under the junction with the zone.

Terebratulina gracilis is one of the most delicate and beautiful fossils found in the chalk, or any other formation. It is very small, with one of the valves flat and fan-shaped. The other valve is slightly raised. It is difficult to find, unless the mealy weathering of the chalk has been washed off by heavy rains. The associated fossils of this zone are widely different from those of the zones above. One of the most striking changes is the absence of *Echinocorys vulgaris* (*Ananchytes ovata*), so predominant in the upper zones of the chalk. The presence of small Ammonites, altogether absent in the higher zones, the absence of *Ventriculites*, and the rather more frequent appearance of Univalves, all indicate a shallower sea. *Discoidea dixoni* is the only echinus, along with a form of *Echinoconus conicus*, that are found in this zone. The former is not so common, perhaps, owing to the small exposure. *Inoceramus labiatus* is found abundantly. The other characteristic fossils are *Cyphosoma corallare*, two undetermined species of *Inoceramus*, *Terebratula carnea*, *Terebratula semi-globosa*, Tooth of *Enchodus Lewesiensis*, and many scales of *Beryx*, a fish of much interest, as it still survives in the deep waters of the present seas.

Zone 9.—*Rhynchonella curieri*. A marked change in the character of the chalk is found in this zone. It is hard, of a darker colour, with dark nodules and streaks, indicating a still shallower water during the deposit. This zone is represented in two small pits near Bevendean Farm and at Norton Farm, distant from the former two and three quarter miles in an easterly direction, and about the same elevation 250 feet above the sea level; also in the lower part of Saddlescombe Pit. The name-fossil is a small *Rhynchonella*. It is common in

the pits named above, especially in Bevendean. It is not usually gregarious, but here it is more so than in Devonshire. There is another distinction, the zone is without flints in Devonshire ; in Bevendean they are quite common. The presence or absence of flints is not a safe guide throughout a zone. In the *Marsupites* zone in Kent flints are almost absent, while in Brighton, near Roedean Cottage, on the sea bed, flints form nearly one-third of the area. Small Ammonites are found at the middle of Falmer Bottom, their last appearance. They are more common in Norton pit, and still more so in Balsdean Pit, perhaps owing to the larger exposure. They are always in casts, and generally much crushed. The species of the specimens exhibited have not yet been determined.

Pleurotomaria perspectiva is the only univalve found in Balsdean pit. *Echinoconus conicus* occurs here in a form peculiar to the zone ; it is higher and more conical than the form in the *Marsupites* Zone. The absence of *Echinoconus sub-rotundus* indicates that the exposures are near to the top of the zone, coupled with the presence of *Holaster planus* at the top of the small Bevendean pit. *Spondylus spinosus* is present in Balsdean and Bevendean pits. It is much smaller than the form found in the *Marsupites* Zone. Two specimens from the same pit have not yet been identified ; they may be *Spondylus (striata)*. *Terebratulina striata* appears in Norton pit. It is found everywhere in the chalk. *Inoceramus labiatus* is found in Falmer Bottom, Norton pit, Balsdean, and Bevendean. From its great abundance, mostly in casts, it is an excellent guide that you are either in the zone above or this. There are several species of *Inocerami* in Balsdean and Norton pits. *Inoceramus curvieri* can be recognised, but the others, being mostly casts, are difficult to determine. *Ostrea hippopodium* is found in Balsdean ; it is more common in the upper zones. *Terebratula carnea* and *Terebratula semi-globosa* are very abundant in Bevendean and Balsdean pits.

Zone 10, Grey Chalk.—A very small exposure on the Lewes Road, north of the Dyke near Fulking represents the upper part of the zone. The name-fossil *Holaster sub-globosus* and *Terebratulina carnea* were found ; the original *Holaster sub-globosus* was so damaged that I will have to place alongside a fine specimen from the grey chalk of Folkestone.

Summary of Results.

The discovery of a Zone of *Uintacrinus* and *Micraster coranytinum* in Kemp Town Quarry and the Dyke, of *Micraster cor-testudinarium* on the Balsdean Road, of *Holaster planus* at the top of Bevendean Pit, of *Terebratulina gracilis* in Saddlescombe,

Falmer Bottom, Bevendean, Norton and Balsdean pits, of *Rhynchonella curvieri* in Bevendean, Norton and Balsdean pit, and of the Grey Chalk at Fulking, north of the Dyke Railway Station.

The appearance and disappearance of forms of life is well defined, and the lesson is taught in all the Zones,—adaptation to altered conditions, or extinction, never to reappear in the same form.

THURSDAY, MAY 8TH.

Some Prehistoric Camping Grounds near Brighton,

BY

MR. HERBERT S. TOMS.

BOTH previously to and during my six years' residence in Brighton, my favourite recreation has lain in scouring the country, at every available opportunity, in search of flint implements and such other material as enables the archæologist to construct, by synthetic and comparative methods, a fairly accurate account of what were the crafts, arts, and customs of the prehistoric inhabitants of Great Britain. Of my many rambles in the fair County of Sussex, which have been principally confined to the Downs, and of the success or disappointment attending them, I do not propose to give a detailed account. The object of the present paper is to lay before you, in the nature of a preliminary report, one result of my local "flint-hunting" expeditions during the last twelve months.

Quite frequently the remark has been made to me that the flint tools of prehistoric men lie scattered broadcast over the surface of the Downs, and in such abundance as to be easily found if one takes the trouble to look for them. One of my friends even went so far as to inform me, in good humour, that he knew of a field where a waggonload might be obtained, and coupled it with the suggestion that my next tramp should be made to the site of this happy hunting-ground. This view of the subject may be a popular one; but, judging from my own

experience, and that of other enthusiastic collectors, I must emphatically state such a view to be erroneous and most misleading.

Before coming to Brighton I had had sufficient training to enable me to detect any flint implement which lay in my path during a walk across the fields or over the hills, and I felt fully qualified to commence similar expeditions in the neighbourhood of Brighton. But, surprising as it now seems to me, my first two years' search in this district were very unproductive ones ; for not one flint axe rewarded my repeated rambles, and, of the few smaller flint implements I came across, none were of such workmanship or presentable appearance as to merit a place in the Museum collection. The result of these disappointments was an extension of my field of explorations to more likely localities. Of these Cissbury comes first on the list. In the entrenchment itself I discovered little of any value. The best hunting-grounds, I found, were the cultivated patches of Downland in its vicinity ; and, in carefully and methodically working these, I met with much success. On my first visit I turned up no less than a dozen flint axes, three only of which were perfect specimens. During another visit I was rewarded with an axe, a gouge, a dagger, and a large boring instrument, the three latter being rare types, hitherto unrepresented in our local collection of flint implements.

An extended search in this district led to the observation that the axes do *not* lie scattered broadcast over the hills, but that they are confined to certain spots, and that, where one finds a single specimen, several others may generally be revealed by a diligent search. This fact also led me both to cultivate a minute observance of any evidence which would enable me to trace such productive sites, and to the endeavour of fathoming the reason why they should occur in this manner.

Such an observance was attended by the discovery that other prehistoric remains invariably and abundantly occur on these spots in close association with the flint axes ; and, as these associated remains have an important bearing on the subject of my paper, I now propose to deal with them in detail. For this purpose I have selected typical examples from the various sites on the Downs. As the initiated will observe, they consist of flint flakes ; flint cores ; hammer-stones ; the smaller flint implements, such as scrapers, needle-makers, arrow-shafters, and borers ; and the calcined flints with which prehistoric man boiled water and cooked his food.

The flint flakes are by far the most abundant, occurring, as they do, by the thousand. These were either chips struck from a flint by primitive man to serve for cutting or scraping purposes, or the chips produced during the fabrication of some flint tool, such as an axe. As the ordinary observer experiences the

utmost difficulty in distinguishing these artificial chips of flint from natural splinters, it is necessary for me to explain, at this point, how such artificial fractures differ from natural ones ; and, for this purpose, I shall have recourse to the most primitive method of producing a flint flake.

"Let us suppose that the primitive savage required a cutting instrument, and that among the flints near at hand there were none with such naturally sharp edges as would fulfil his purpose. By experiment and research we know, in such a case, he selected from the flints near at hand one about the size of his fist, to serve as a hammer, and another of a convenient size from which to strike chips or flakes, which would also serve for cutting purposes. If the flint to be chipped was small, he held it in his hand to undergo the operation. If too large to be held comfortably in the hand, it was probably rested on the thigh : then, with a well-directed blow from his hammer-stone, he struck a chip from the other flint. Let us now examine such a chip or flake, as it is technically termed. We shall first observe that it has a flat top upon which the full force of the hammer-stone was concentrated. Directly underneath this flat top, and on the smooth side of the flake, which fits into the hollow from which it was struck, we observe a little rounded protuberance ; this is known as the bulb, or cone, of percussion. In a typical flake we then notice the existence of approximately concentric rays covering the flat surface of the flake on the same side as the bulb of percussion. In some instances these rays and the bulb of percussion are so pronounced as to give the flake the appearance of a fossil shell cast in flint ; the bulb of percussion simulating the umbo or top of the shell, and the concentric rays the divisions of its periodic growth. To this resemblance is due the coining of the term "conchoidal," or shelly fracture, now applied to the artificial to distinguish it from natural fractures which lack these characteristics. When we examine the hollow from which the flake was detached, we naturally observe the above characteristics in a reversed form. This hollow is known as a facet.

"To proceed a stage further, let us assume our flint chipper has struck flake after flake from the same flint till none of its original surface remains, the whole being covered with the facets of the detached flakes. It is obvious that the next flake taken off will bear the imprint of one or more of the facets from which the previous flakes were removed. To produce a good symmetrical flake from such a core of flint, the blow should be delivered directly above the divisional line of two adjoining facets, the result will then be that this line will form a ridge running down the middle of the detached flake.

"Flaking with the hammer-stone, as described above, is a knack not very readily acquired ; and, where the production of long, symmetrical flakes is concerned, it is extremely difficult,

necessitating, as it does, long, careful, and thoughtful practice. To obtain such a result as a flint flake, the flint to be chipped should be retained, by some means or other, in an elastic medium—an elastic medium, however, is not a *sine quâ non*, although it is preferable—and the blow of the hammer-stone must be sharp and delivered with precision.

"Lord Avebury has gone so far as to state that '*a flint flake is to the antiquary as sure a trace of man as the footprint in the sand was to Robinson Crusoe.*'" My observations, however, enable me to say that this statement requires some modification. One would infer from such a remark that the production of a conchoidal fracture by any natural agency is a sheer impossibility. Such, though, is not the case. There are many ways in which flakes can be and are produced by natural causes where the underlying principle of flaking practically amounts to the same as the artificial process described above. One local instance will suffice in explanation: Maybe many of you have walked from Brighton to Rottingdean along the shore. If so you will have observed that wherever the rough seas had washed away the shingle between high and low water marks, it had laid bare the chalk floor. You will agree with me, too, that this uneven surface requires some circumspection to traverse in safety; for the water left in the depressions seems to exert a great attraction over one's feet, and, in the endeavour to avoid these pools, the chances are manifold that one's ankles or shins become barked by the flint boulders projecting out of the chalk floor. Now it is to these boulders, held firmly in the chalky matrix, that I wish to draw your attention. Our first and lively impression is that they are very abundant; our second impression, on closer inspection, is that many of them distinctly show conchoidal facets. Now, after I have emphatically stated that the knack of chipping flakes from a flint is not easily acquired, you will ask how the flaking on these rough boulders was produced. The answer is simple. It was effected by natural attrition with other loose boulders and pebbles, the motive power being supplied by the waves of the rough seas. By chance it happened that some few of the boulders and pebbles, swept to and fro by the waves, struck the projecting flint at the correct angle and with the proper force, and then off flew a flake. Such chips, produced by the blind forces of nature, are irregular, unsymmetrical, and generally of small size, and a little practice enables one to distinguish with accuracy between this natural flaking and the comparatively beautiful and thoughtful workmanship of the hand of man. Whenever we come across a symmetrical or well-formed flake which exhibits the portions of at least two facets on its outer face, then, and then

only, I think we may dogmatically assert that such a flake is, in ninety-nine cases out of a hundred, '*as sure a trace of man as the footprint in the sand was to Robinson Crusoe.*'^{*}

As the majority of the flakes found in association with the axes on the productive spots are well-formed and show evidence of skilled workmanship, we may conclude they were produced by primitive man in fashioning his flint tools, or, as I have already mentioned, for use as cutting or scraping instruments.

Before quitting these introductory remarks on artificial flint chips, there is yet another and an important characteristic exhibited by many of them to which I am tempted to draw your attention. In examining a collection of prehistoric flakes, one often observes specimens with a facet on the bulb of percussion (fig. 12) caused by the removal of a more or less minute flake. In scientific terminology, this little facet is known as an *éraillure*. It has recently been described as the secondary hallmark of a man-made flake†, and has hitherto been maintained as a valuable criterion by the champions of the authenticity of the so-called Eolithic or Plateau implements and of the rude tools of early Palæolithic times.

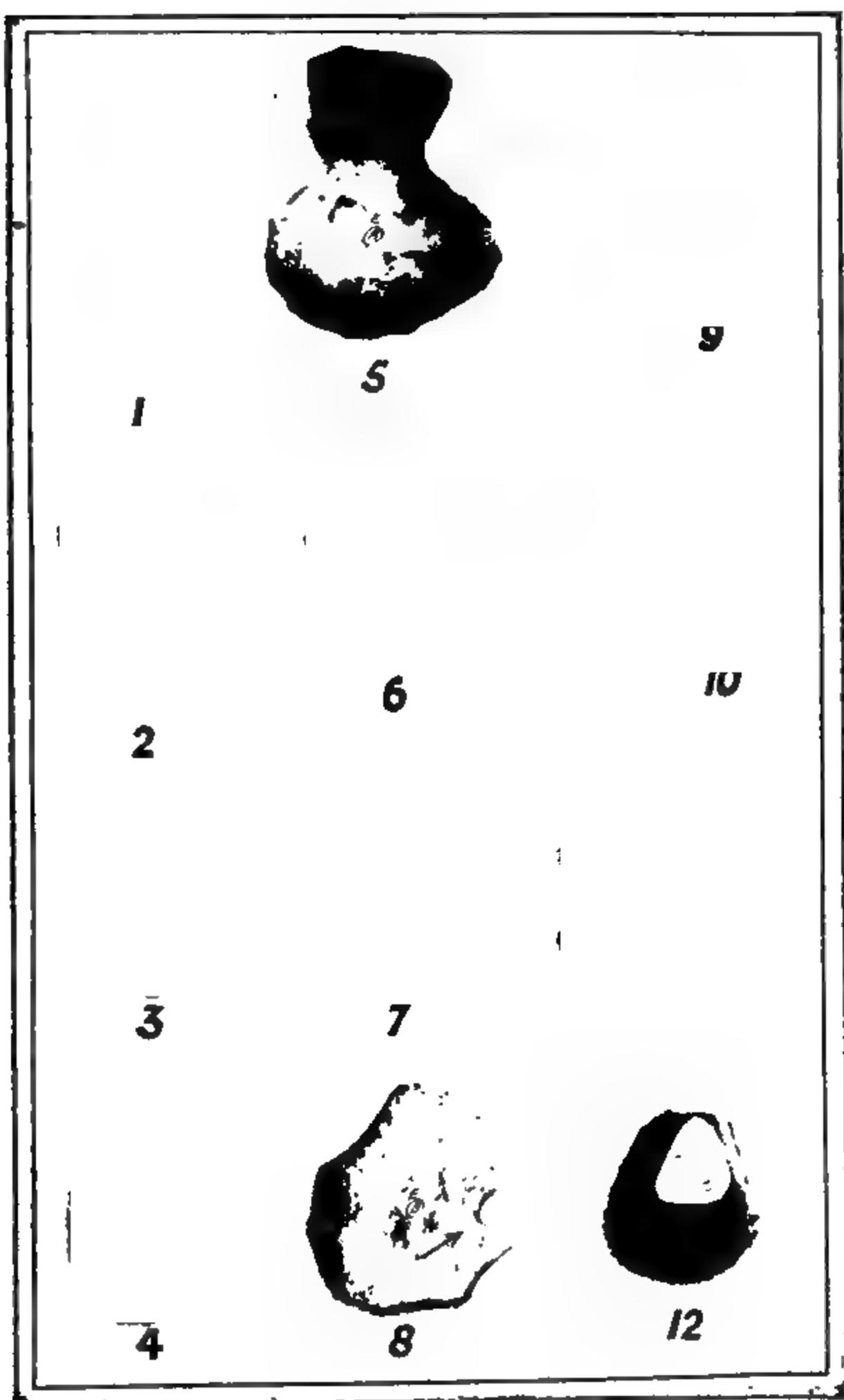
Mr. W. J. Lewis Abbott, F.G.S., has explained the cause of an *éraillure* to himself in the following manner:—"In an ordinary blow one just brings the hammer upon the object, and is regardless of the rebound, which generally initiates the return motion, and thus is unrecognised; but, when one wants to hit in a certain place, in a certain definite direction, there is an unconscious concentration of all muscular power to make the blow fall at that particular spot, and even keep the hammer there, and this voluntary muscular opposition offered to the uprise of the striker forces it back, occasioning a secondary but light blow. This can also be well seen and heard when one attempts to drive a nail in an awkward place by a series of slow, deliberate blows, each of which will be followed by a second involuntary tap. It is this tap which removes the small flake from the bulb of percussion, and produces the well-known *éraillure*. This, therefore, is characteristic of an intentionally directed blow. Upon submitting a specimen to Mr. J. Allen Brown, F.G.S., he at once noticed this inestimable hall-mark. All experiments thus point to the *éraillure* as being altogether more important than a mere bulb of percussion, and, so far as we are aware, may be taken as a proof of man's work, as it can easily be seen among flakes intentionally removed from a block, but so far as is known under no other circumstances."‡

* *Experiments in a Lost Art*, by H. S. Toms.

† *The Authenticity of the Plateau Implements*, by W. J. Lewis Abbott, F.G.S., *Natural Science*, vol. xii., page 114.

‡ *Worked Flints from the Cromer Forest Bed*, by W. J. Lewis Abbott, F.G.S., *Natural Science*, vol. x., pages 92-93.

• Implements from Prehistoric Camping Grounds.



Figs. 1-4, scrapers; fig. 5, combined needlemaker and scraper; figs. 6-8, needlemakers; figs. 9-11, arrowshafts; fig. 12, flake showing brisure

Quite recently I have carried out a long series of flaking experiments in the endeavour to verify, if possible, Mr. Lewis Abbott's view with regard to the production of an *éraillure*, and as to its being such an inestimable hall-mark of man's handiwork ; but, so far, my efforts in this respect have led me to a very different conclusion.

In the first instance, my experiments have convinced me that, to produce a flake, the rebounding blow, which has been so harped upon, is not an absolute necessity. I have intentionally delivered blows at such angles as to render impossible a rebound or a re-striking of the flint with the hammer-stone, and, invariably, such a single blow has successfully detached a respectable flake ; and, what is of far more importance, many of the flakes so struck off by single blows have exhibited the characteristic *éraillure*. This, therefore, entirely negatives Mr. Lewis Abbott's theoretical explanation as to its being due to the involuntary rebounding tap. Occasionally I have succeeded with a single blow in detaching a flake with two or more *éraillures* ; and, after careful consideration, to my mind, the most feasible explanation of their production lies in the uneven surface of the hammer-stone at the point of impact. At any rate, the existence of an *éraillure* on a flake cannot, in my opinion, be considered as characteristic of an intentionally delivered blow. I have instanced above the natural production of conchoidal fractures, and, as my experiments have shown an *éraillure* can be and is often caused by a single blow, I see no reason why natural flakes should not bear the same characteristic.

Reverting once more to the subject of my paper, I will now direct your attention to the flint cores. These are merely blocks of flint, generally of small size, covered with the facets of artificially detached flakes. They represent the residuum of large flint boulders from which prehistoric man chipped flakes of convenient sizes to make into cutting and scraping instruments. These also occur in abundance, and were evidently cast aside as useless when no flakes of the desired shape and size could be struck from them. It has been suggested that some of the smaller cores were used as sling-stones ; but this is merely conjecture. As a rule they are not of any uniform size or shape, and the existence of shore pebbles with them points to the inference that the latter would by preference have been used as sling-stones if, indeed, the sling were in use in this part of the country in prehistoric times.

The flints which prehistoric man used as hammer-stones in flaking next claim our attention. These, too, are by no means uncommon, and are invariably turned up wherever other evidence of primitive man abounds. They are, as you will observe in the examples exhibited, generally round flints—occasionally shore pebbles—which rarely exceed the size of one's fist, and are more

or less covered with comparatively minute indentations. These indentations, moreover, form the principal evidence which goes to prove they were used as hammer-stones; for, by experiment, one ascertains not only that flints of this shape and size are the most convenient to handle and of the right weight to produce the force necessary to detach a flake, but that continuous chipping results in giving them similar indentations, and, in fact, the exact appearance of the hammer-stone of prehistoric times. Occasionally one comes across a flint core which has been used as a hammer-stone.

Of the smaller flint implements awaiting description, the most common is the scraper (figs. 1-4). This tool is invariably a flint flake re-chipped to a round and bevelled edge. The opinion is that these scrapers were used by primitive man in dressing the skins of animals; for, among the Eskimos, a similar instrument was, and—I believe I am correct in so stating—is still used for the same purpose. Several of these Eskimo scrapers are to be seen in the principal Museums of Europe and America, and, in his classic work on Stone Implements, Sir John Evans figures one as a comparison with the scrapers of prehistoric times.* Many of the scrapers one finds on the Downs are beautifully formed, and, as they are of all shapes and sizes, the probability is they were used for a variety of purposes in a variety of ways. Judging by my own experiments in flint chipping, I may say these little tools are easily and rapidly made, and to this may be due the fact of their occurrence in such numbers.

I now ask you to closely examine the two scrapers which have little semi-circular notches chipped out of their edges (fig. 5). With these are arranged a number of flakes which also exhibit similar notches of varying sizes. It is evident they were used as a spoke-shave for scraping or pointing some cylindrical object. In *Natural Science* is figured a similarly notched flake of white quartz, which is described as having been used by the Red Indians of the Sacramento Valley, U.S.A., for pointing their bone needles.† The notches in many of the local flakes would seem to have been serviceable for a similar purpose. In others, though, the notches are much too large for this, and might have been employed for scraping or smoothing the shafts of arrows or other wooden articles. Such hollow or concave scrapers have therefore been provisionally termed, according to their respective sizes, bone needle-makers (figs. 6-8) and arrow-shasters (figs. 9-11). These needle-makers occur nowhere so abundantly as on the Sussex Downs, and it at first occurred to

* *Ancient Stone Implements*, p. 268, fig. 203.

† *The Authenticity of the Plateau Implements*, by W. J. Lewis Abbott, F.G.S., *Natural Science*, vol. xii., No. 72, plate vi., fig. 58.

me that the majority of the little notches might have been produced naturally. In order to ascertain whether this might be the case, I devoted some time to the endeavour to reproduce them both on the old surface flakes and on flakes newly struck from a flint. My attempts to fashion such semi-circular notches by blows from a small hammer-stone, a pointed flint, or the edge of another flake ended in a complete failure. Further experiment convinced me that the majority of the smaller and well-formed notches could only have been produced by quite a different and more refined mode of flaking ; the flaking instrument used being a pointed piece of bone or horn, and the minute flakes being detached by pressure and not by blows. Not a little skill, too, is required for the operation ; although, once the knack of flaking by pressure is acquired, they are readily and quickly made.

Having satisfied myself as to the very probable method employed in the intentional production of these needle-makers, another question arose, namely, could any of the notches have been produced unintentionally by prehistoric man during the operation of fashioning his bone spears, bone awls, or needles with the sharp edge of a flake ? The bone handle of an old tooth brush with angular sides came as a timely aid at this point in my investigations. With the edge of a flake I not only made its sides rapidly assume a convex form, but I found that the pressure against the edge of the flake had detached a number of minute chips, resulting in the formation of a concave notch of the same size and shape as the convex edge of the tooth brush. On comparing my handiwork with the prehistoric needle-makers, I saw, much to my gratification, that it was an exact replica of the smaller kinds. This simple experiment leads me to believe that many of the ancient specimens were unintentionally formed in a similar manner. Personally, I think we may take for granted that but few of the notches on these hollow scrapers were naturally produced. In the case of the larger specimens, it is probable that many of them were fashioned by blows from a pointed stone, as I have succeeded in reproducing several in this manner.

In speaking of the arrow-shafters, Dr. Thomas Wilson, of the United States National Museum, says : "The scrapers with a concave edge, for scraping arrows, are rarely found in prehistoric collections. . . . The United States National Museum possesses some, but not many. They seem not to have been recognised or cared for, and were not gathered by collectors." *

* *Arrowpoints, Spearheads, and Knives of Prehistoric Times*, by Thomas Wilson, LL.D., Annual Report Smithsonian Institute, 1897, p. 885.

The small tools, termed borers, require little description. In the majority of instances they are flakes chipped to a sharp point to serve as boring or piercing instruments. In regarding these, the ordinary observer may feel rather sceptical as to their boring or piercing capabilities ; but experiment proves they admirably answer the purpose of boring holes in wood or bone. This I successfully demonstrated to some sceptical friends by boring a perfectly circular hole with one of these rude tools through the handle of a hat brush. The discovery of these borers in connection with the flint axes is a rare occurrence, and but few have hitherto rewarded my many rambles over the Downs.

With the exception of the flint axes, the tools described above are not such as could have been well employed as weapons of offence or defence. They evidently served more pacific purposes in the domestic phase of primitive man's life ; and, we may depend, they played an important part in the preparation of animal hides as clothing, the covering of their huts or tents, &c. Of the existence of habitations on these productive sites there is an entire lack of evidence ; but, that food was cooked or water boiled on these spots, there is a profusion of proof existing in the enormous quantities of what are known as "pot-boilers," or cooking stones. From the examples exhibited you will perceive they are approximately round flints, of varying sizes, and that they differ in colour from ordinary flints, as well as in the multitude of cracks which extend through them in every direction. This greyish tint and cracked appearance can only be reproduced in one way, namely, by heating flints to a high temperature, either directly or indirectly, by fire. In the fortified camps of prehistoric man these burnt flints occur in thousands ; and it is now generally recognised among archæologists that they were employed in the cooking operations of the prehistoric tribes, who, like many savages of recent years, had no pottery or other vessels which would stand the heat of the fire.

The following quotation from Professor Tylor will give you a fair idea of this method of stone-boiling as it obtained among the savages of North America :—

"There is a North American tribe who received from their neighbours, the Ojibwas, the name of Assinaboins, or Stone-Boilers, from their mode of boiling their meat, of which Catlin gives a particular account. They dig a hole in the ground, take a piece of animal's raw hide, and press it down with their hands close to the sides of the hole, which thus becomes a sort of pot or basin. This they fill with water, and they make a number of stones red-hot in a fire close by. The meat is put into the water, and the stones dropped in till the meat is boiled. Catlin describes the process as awkward and tedious, and says that, since the Assinaboins had learnt from the Mandans to make

pottery, and had been supplied with vessels by the traders, they had entirely done away with the custom, 'excepting at public festivals, where they seem, like all others of the human family, to take pleasure in cherishing and perpetuating their ancient customs.' Elsewhere, among the Sioux or Dacotas, to whom the Assinaboins belong, the tradition has been preserved that their fathers used to cook game in its own skin, which they set up on four sticks planted in the ground, and put water, meat, and hot stones into it. The Sioux had the art of stone-boiling in common with the mass of the northern tribes. Father Charlevoix, writing above a century ago, speaks of the Indians of the North as using wooden kettles and boiling water in them by throwing in red-hot stones, but, even then, iron pots were superseding both these vessels and the pottery of other tribes. To specify more particularly, the Micmacs and the Souriquois, the Blackfeet and the Crees, are known to have been stone-boilers; the Shoshonees or Snake Indians, like the far more northerly tribes of Slaves, Dog-Ribs, &c., still make, or lately made, their pots of roots plaited, or rather twined, so closely that they will hold water, boiling their food in them with hot stones; while, west of the Rocky Mountains, the Indians use similar baskets to boil salmon, acorn porridge, and other foods in, or wooden vessels such as Captain Cook found at Nootka Sound, and La Pérouse at Port Frangais. Lastly, Sir Edward Belcher met with the practice of stone-boiling, in 1826, among the Esquimaux at Icy Cape."*

In Australasia and many of the Polynesian Islands, the practice of stone-boiling was in universal use until comparatively recent times. It is now, however, being rapidly superseded by the introduction of metal pots and pans of European origin. The large wooden bowl on the table is said to have been used by the inhabitants of Banks Island, New Hebrides, in conjunction with heated stones for cooking food.

It has been suggested that many of the so-called pot-boilers found on the cultivated patches of the Downs are merely flints which have been accidentally burnt in couch or other refuse heaps. This may be the case in a few instances; but the genuine articles are readily recognised by their aged and weathered appearance, and also by their similarity with the undoubted specimens from the prehistoric entrenchments and habitation sites.

Having completed my brief and analytic description of the remains found in association on these productive spots, we will now turn to the Ordnance Surveys, and note the positions of a few of the most typical of such sites which I have discovered and paid repeated visits to during the past year or so. In the neighbourhood of Cissbury you will observe there are three. One

* *Early History of Mankind*, pp. 263-264.

on the crest of Lychpole Hill, about half a mile south-east of the entrenchment ; another about 400 yards to the east ; and the other on the spur of the Downs, known as Mount Carvey, which slopes from Cissbury towards Broadwater. Flakes, cores, scrapers, cooking stones, refuse axes, &c., are to be found in spots throughout the length and breadth of this latter spur ; but the example marked on the map has proved the most typical and most productive. The areas of these and the other sites I have yet to mention are very varied, some being less than a quarter of an acre in extent, whilst, in others, the " finds " lay scattered in groups over several acres.

The next ordnance sheet shows the positions of three comparatively small but very productive sites bordering the summit of the eastern escarpment of the Downs in the neighbourhood of Beachy Head. For the purpose of reference I have indicated these respectively as A, B, and C. A is situated on the northern slope of Crapham Hill, C on Pea Down, and B about half a mile north on the same spur of the Downs known as the Peak. In this district I have failed to come across one perfect axe, my discoveries being confined to refuse portions of small but beautifully chipped axes, and to the usual well-formed flakes, showing evidence of expert workmanship, scrapers, needle makers, &c. On site B an acquaintance of mine recently discovered a perfect and delicately worked barbed arrowhead when walking over the ground with me.

The marked scarcity of large and complete axes in this district is, in my opinion, obviously due to the depredations of the ubiquitous stone-picker. Last year, when working the Beachy Head district, I came across a dozen men, women, and boys who were engaged in picking flints for road material from the cultivated land, and I found that, owing to their frequent conversations with collectors, every man, woman, and boy had become possessed of sufficient knowledge to recognise a " war-stone "—the name it has pleased them to give a flint axe—whose value might represent anything from sixpence to as many shillings, according to the excellence of the specimen and to the length of the collector's purse. But, in many instances, the stone-picker is not so acquainted with a rudimentary knowledge of these artificially chipped flints, and consequently many (yes, very many) beautiful specimens are gathered and subsequently cracked up as road material. In this way the Downs are being rapidly denuded of the flint implements. Happily, however, the majority of the smaller tools are left behind, and thus afford sufficient evidence to enable one to still trace the spots where they most abound.

Last year, when walking by the side of the cultivated field which adjoins the Dyke Road in front of the Booth Museum,—the site Mr Councillor Carden lately proposed as a new park for Brighton,—my eye was arrested by a beautiful little scraper which

lay within reach of my walking stick just over the wire fence. This led me to trespass and to the discovery that the surface of the field near the fence was covered with flakes and cooking stones. I then applied to Mr. J. J. Clark for permission to walk over the field, which he kindly granted me. Since then I have repeatedly worked the field, and have found that the cooking stones, flakes, scrapers, needle-makers, cores, &c., occur more or less in groups over its whole surface. Of the larger implements I have only discovered the halves of flint axes, both rough and polished, including a large roughly chipped axe, probably a waster, which has subsequently proved one of the most interesting surface implements I have yet found. Its special characteristic is a small patch of glaze on one of the facets, which Professor Boyd Dawkins says is identical with that hitherto only observed on a few of the older river-drift implements.* The question of the origin of this natural glaze is yet unsolved. It is, moreover, a question which cannot detain us on the present occasion.

The next spot to be mentioned is the most typical I have to bring before your notice. This is situated in the open fields on each side of the Dyke Road just beyond the last reservoir and about half-way from the clock tower to the Dyke. Here I have discovered several fine and perfect axes, and some of the most beautiful scrapers I have ever seen. With these, too, were associated the usual quantities of flakes, cooking stones, and many of the other smaller flint tools.

The finest axe it has ever been my lot to add to the Museum collection, I accidentally turned up about two years ago near the south-western summit of Newmarket Hill, known locally as Norton Top. This is now shown mounted in a wooden handle of very modern appearance to represent the probable style of hafting. Its discovery induced me to thoroughly work the brow of the hill and the cultivated land in its vicinity as far as the growth of the crops would allow. But, with the exception of one small but prolific spot near Wick Farm, a quarter of a mile to the south-west of the hill, this locality at first proved very barren. This particular spot, the last I have to bring before your notice, was absolutely littered with delicate flakes. Cooking stones, too, were in abundance, and, associated with them, were many finely worked scrapers, including several of exceptionally small size. Before leaving this part of the Downs, I may mention that Norton Top has recently been laid bare of its crops and so enabled me to give it a thorough overhaul. A few solitary pot-boilers lie strewn here and there over its surface unaccompanied by any of the smaller flint implements; but, not far from the spot where the flint axe was found, there are

* *Palæolithic Implements from Savernake*, by Edgar Willett, M.B., Journal of the Anthropological Institute, vol. xxxi., page 310.

hundreds of well-formed flakes grouped together and confined to small spaces only a few square yards in extent. Such spots as the latter are commonly termed fabrication sites, or, in other words, places where primitive man made a halt or periodic visits in order to dig into the clayey mould capping the hillside for flints from which to make his flint tools. Whether either of these represents the spot where the axe exhibited was fabricated, it is of course impossible to say, although it is probable, owing to the axe exhibiting no sign of ever having been used.

This brings me to the conclusion of my brief description of these productive sites and of the implements found in association on them. There are many others scattered over the Downs in the three districts mentioned ; but, as yet, I have not had sufficient leisure to overhaul them thoroughly, and I have deferred marking their positions on the maps till this has been done. They are by no means common, and often, when I have set out on a prospecting tour over the Downs, I have walked miles without coming across a single flake, cooking-stone, or the least trace of a new site. Those I have already discovered are generally situated on or quite near some eminence which commands a wide view of the surrounding country.

From the array of evidence we may deduce the obvious conclusion that these productive areas were frequented by the members of some primitive tribe, not only for the purpose of boiling water or cooking food, but for making their flint tools and for preparing animal hides as clothing, tent coverings, and other articles for domestic use. Lacking a better term, I have therefore given these sites the name of "Camping Grounds."

The problem now inviting our solution is the question as to what period may we assign these camping grounds. Judging by the nature of the "finds," many of you may have no hesitation in saying we may at once relegate them to a position in the Neolithic phase of the Stone Age. Before venturing any opinion, however, it is necessary that we examine the evidence of the extent and duration both of flint chipping and of the practice of stone-boiling in the south of England. From the character of the exhibits I think we may safely omit any reference to the older stone periods, and confine our attention to the consideration of the later prehistoric and early historic times.

In the Neolithic period, flint chipping in England had not only merged from a craft into a fine art, but it had attained its highest degree of perfection. As to the duration of this high standard of excellence we are unable to say, but recent research seems to point to the inference that the art exhibited little sign of decadence till the transitional period of the substitution of bronze tools for those of stone was far advanced. Moreover, the abundance of flakes, scrapers, hammer-stones, &c., found in association with the remains of the Bronze, Early Iron, and

Roman Ages clearly shows that a modified form of flint chipping long survived the introduction of the use of metals. If we take into consideration the fabrication of flint flakes for use as strike-a-lights and gun-flints, we may trace its continuity through prehistoric and early historic times right down to the present day.

Viewing the discoveries of burnt flints, or pot-boilers, in a similar light, we find there are authentic records of their invariable and abundant occurrence in association with the remains of the Neolithic, Bronze, Early Iron, and Roman Periods, thus showing the practice of stone-boiling and flint chipping survived together from the Neolithic period down into early historic times. A pot-boiler, flint flake, scraper, &c., found on the surface of the Downs, may consequently belong to any one of the above ages ; and the difficulty of assigning even an approximate period to such surface finds will now be very apparent.

Before proceeding further, I would acquaint you with yet another interesting survival, namely, the hand-made pottery of prehistoric times. In a former paper read to this Society,* I pointed out the rare occurrence of pottery in any shape or form in association with the remains of the Neolithic people. From the few fragments hitherto discovered, we know it to be a coarse and badly-baked hand-made type of pottery. In the succeeding period—the Bronze Age— the pottery exhibits evidence of great improvement, though it was still of a coarse character and made solely by the hand. Moreover, judging by the complete specimens and the enormous number of fragments invariably found with the remains of this age, pottery seems to have been in universal use. Of the introduction of the potter's wheel during the Early Iron Age, we have ample proof in the number of "lathe-turned" specimens discovered, and the universal adoption of the potter's wheel in Roman times must have been so well shown in my former paper as to need no further comment here.

At a recent meeting of this Society, there were exhibited five cinerary urns, presented to the Museum by Mr. W. Henry Campion, which were found in the sand pit at Hassock's Gate last year, associated with a number of Roman pots, the majority of the latter also containing cremations. In fact, judging by the nature of the various "finds," the place seems to have been the site of a Roman Cemetery. As you may have observed, the five urns are all hand-made, and similar, in every respect, to those of the Bronze Age. Their occurrence, therefore, with Roman pottery in a Roman Cemetery, and not according to the stereotyped modes of burial which obtained in the Bronze Age, at first seems very problematical. But, in excavations made by

* *The Pottery of Prehistoric and Roman Britain*, by H. S. Toms ; Proceedings of Brighton and Hove Natural History and Philosophical Society, 1900-1901.

the late General Pitt Rivers, F.R.S., many fragments of hand-made pottery, identical with the two qualities of these coarse urns, were frequently found in connection with "lathe-turned" pottery and other Roman relics. These urns, though, are the first and only instance I know of complete specimens of this type of pottery occurring with Roman remains. The above facts point to the inference that the fabrication of the primitive, hand-made type of pottery long survived the introduction of the potter's wheel in the South of England; and, hence, another difficulty arises, namely, that of assigning an exact period to any specimen of hand-made pottery one happens to find out on the Downs.

I fear by this time the question as to the probable age of the camping grounds seems bristled with difficulties. But let us now take a retrospective view of the whole situation. We have seen it is not an infrequent occurrence to find handmade pottery, cooking stones, and the smaller flint implements with Roman and the so-called Late Celtic remains; and, that where they are thus discovered, they are invariably accompanied by numerous fragments of the pottery of the periods in question. The latter remark equally applies to the Bronze Age, for, wherever the Bronze-using Briton went, he seems to have taken his pots and pans with him; and, if we may judge by the multitude of the shards occurring with his remains, the ceremony of "washing up," in those days, must have often been attended with drastic results.

Now I have been constantly on the look-out for the occurrence of pottery, in any shape or condition, on the camping grounds, in the hope it might afford some clue as to the period to which they belong. But, with one solitary exception, I have entirely failed in this respect. The exception was the discovery of a small fragment of Romano-British pottery on the camping ground near the Dyke Road Reservoir; but the utter invalidity of such a piece of surface evidence was singularly demonstrated by the immediate discovery, on the same spot, of another fragment of pottery which bore the magic inscription that a certain brewery was located in such-and-such a place. This combined discovery gave rise to the remarkable query as to whether the camping ground in question belonged to the period of the Roman Occupation or to the flourishing period of Tamplin's Fine Ales!

After such a preamble of conflicting theories, I will, in conclusion, venture my opinion as to the age of the camping grounds. The fact that the flint axes found on these sites are purely Neolithic in character, and that they occur nowhere so abundantly as in association with the smaller implements and cooking stones, coupled with the strong negative evidence which exists in the marked absence of pottery of any shape or kind, seems, to me, to point to only one conclusion, namely, that these camping grounds are distinctly those of the Neolithic tribes.

WEDNESDAY, JUNE 11TH, 1902.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 11TH, 1902.

During the past year six Papers have been read, the full titles of which are appended, at the Ordinary Meetings of the Society. In addition to these two Lectures have been given by Prof. Flinders Petrie and Mr. Fred. Enock respectively, to which the public have been admitted on payment. Notwithstanding the attractive nature of their subjects and the eminence of the lecturers the Council regrets that the attendance was not so large as might have been expected. It will therefore be a matter for serious consideration whether this plan of providing popular Lectures shall be continued.

Mr. Pankhurst, who had been for sixteen years Scientific Secretary of the Society, resigned that position last October. He has, however, in the absence of a successor, assisted the Secretary in the work with which he was so familiar. The Council cannot part with Mr. Pankhurst after so many years' service as Honorary Secretary without expressing their deep sense of the obligation which the Society is under to him for his valuable assistance. The Council regrets that hitherto they have been unable to find a gentleman willing to undertake the duties of the office which he vacated.

There were two Excursions, namely, on June 22nd, 1901, to Wiston, and May 24th, 1902, to Worth Forest, Balcombe. A third Excursion to Ashdown Forest was arranged, but postponed through inclement weather.

Papers read at Ordinary Meetings :—

1901.

Nov. 14th. "Polar Problems, Arctic and Antarctic."—

Mr. MILLER CHRISTY.

Dec. 11th. "Parasites, Vegetable and Animal."—

Mr. D. E. CAUSH.

1902.

Jan. 15th. Evening for Exhibition of Specimens. Short Paper on "Some Optical Illusions."—

Mr. E. A. PANKHURST.

Feb. 20th. "British Vegetable Galls."—

Mr. E. T. CONNOLD, F.E.S.

April 10th. "The Zones of the Chalk near Brighton."—

Mr. W. MCPHERSON, F.G.S.

May 8th. "Some Pre-historic Camping Grounds near Brighton."

Mr. H. S. TOMS.

In addition to these two Lectures have been given in the Pavilion, to which the public were admitted on payment, viz.:— On October 17th, 1901, by Prof. FLINDERS PETRIE on "Excavating in Egypt and its Results," and on March 4th, 1902, by Mr. FRED. ENOCK on "Insect Architects and Engineers."

LIBRARIAN'S REPORT.

The rebuilding of the Public Library has caused the closing of the Society's Library during the past three months, and a detailed report is accordingly postponed till next year. It is expected that by November, at latest, issues will be resumed; and a new catalogue will then be prepared. The new conditions which the new buildings will necessitate will doubtless be favourable to an increase in the utility of the Library.

H. DAVEY, JUNR.,

Hon. Librarian.

METEOROLOGY OF BRIGHTON.

Month.	TEMPERATURE OF AIR DURING MONTH.			Humidity of Ratification - 100.
	Highest.	Lowest.	Mean.	
July,	81.8	64.7	73	50.2
1877-1901	85.0	62.0	71	45.0
"	84.0	63.6	70	46.8
August,	89.4	62.2	74	44.3
"	87.7-1901	80.9	77	45.0
September,	80.2	58.4	78	35.9
1877-1901	83.2	53.4	78	34.0
"	88.8	51.7	78	29.5
October,	80.1	45.4	74	34.0
1877-1901	73.0	23.6	74	26.4
"	66.4	17.9	79	26.4
November,	63.5	23.6	78	29.5
"	54.0	17.6	78	29.5
December,	60.4	27.0	79	29.5
"	50.8	12.0	79	29.5
January,	63.6	31.2	79	30.2
1877-1901	49.0	17.4	79	30.2
"	58.0	33.2	80	30.2
February,	60.2	40.4	80	30.2
1877-1901	65.0	45.9	81	30.2
"	65.0	42.3	81	30.2
March,	64.3	47.8	81	30.2
1877-1901	75.4	47.9	80	30.3
"	68.8	34.0	77	30.3
April,	78.1	30.0	71	30.3
1877-1901	81.6	43.0	71	30.3
"	85.0	37.0	70	30.3
May,	84.0	21.2	79	33
1877-1901	85.0	12.0	78	33
June,	84.0	50.9	79	49
"	85.0	50.3	78	49
Entire Year	84.0	21.2	75	33
Average of 1877-1901	85.0	12.0	75	33

Relative Humidity of Ratification - 100.

Month.	WIND.								RAINFALL.	SUNSHINE.
	N.	N.W.	E.	S.E.	S.	S.W.	W.	N.W.		
July,	1	6	1	4	6	5	-	2	6	268.50
1877-1901	12	10	13	11	4	11	3	-	1	218.94
"	12	10	13	11	4	11	3	-	1	257.24
August,	1	1	1	1	4	11	4	-	1	204.43
"	1	1	1	1	4	11	4	-	1	131.48
September,	1	1	1	1	4	11	4	-	1	158.29
1877-1901	1	1	1	1	4	11	4	-	1	107.17
"	1	1	1	1	4	11	4	-	1	113.35
October,	1	1	1	1	4	11	4	-	1	96.98
1877-1901	1	1	1	1	4	11	4	-	1	67.92
"	1	1	1	1	4	11	4	-	1	57.91
November,	1	1	1	1	4	11	4	-	1	50.63
"	1	1	1	1	4	11	4	-	1	57.00
December,	1	1	1	1	4	11	4	-	1	59.54
"	1	1	1	1	4	11	4	-	1	73.40
January,	1	1	1	1	4	11	4	-	1	86.00
1877-1901	1	1	1	1	4	11	4	-	1	122.08
"	1	1	1	1	4	11	4	-	1	135.31
February,	1	1	1	1	4	11	4	-	1	168.82
1877-1901	1	1	1	1	4	11	4	-	1	168.08
"	1	1	1	1	4	11	4	-	1	183.98
March,	1	1	1	1	4	11	4	-	1	200.38
1877-1901	1	1	1	1	4	11	4	-	1	198.43
"	1	1	1	1	4	11	4	-	1	213.15
April,	1	1	1	1	4	11	4	-	1	63
1877-1901	1	1	1	1	4	11	4	-	1	64
"	1	1	1	1	4	11	4	-	1	1810.89

Month.	Number of Days of Sunshine.								RAINFALL.	SUNSHINE.
	N.	N.W.	E.	S.E.	S.	S.W.	W.	N.W.		
July,	6	12	10	13	11	4	11	3	3.42	268.50
1877-1901	12	10	13	11	4	11	3	-	2.34	218.94
"	12	10	13	11	4	11	3	-	1.74	257.24
August,	1	1	1	1	4	11	4	-	2.38	204.43
"	1	1	1	1	4	11	4	-	1.14	131.48
September,	1	1	1	1	4	11	4	-	2.50	158.29
1877-1901	1	1	1	1	4	11	4	-	1.46	107.17
"	1	1	1	1	4	11	4	-	1.14	113.35
October,	1	1	1	1	4	11	4	-	0.35	96.98
1877-1901	1	1	1	1	4	11	4	-	0.25	67.92
"	1	1	1	1	4	11	4	-	0.25	57.91
November,	1	1	1	1	4	11	4	-	0.25	50.63
"	1	1	1	1	4	11	4	-	0.25	57.00
December,	1	1	1	1	4	11	4	-	0.25	59.54
"	1	1	1	1	4	11	4	-	0.25	73.40
January,	1	1	1	1	4	11	4	-	0.25	86.00
1877-1901	1	1	1	1	4	11	4	-	0.25	122.08
"	1	1	1	1	4	11	4	-	0.25	135.31
February,	1	1	1	1	4	11	4	-	0.25	168.82
1877-1901	1	1	1	1	4	11	4	-	0.25	168.08
"	1	1	1	1	4	11	4	-	0.25	183.98
March,	1	1	1	1	4	11	4	-	0.25	200.38
1877-1901	1	1	1	1	4	11	4	-	0.25	198.43
"	1	1	1	1	4	11	4	-	0.25	213.15
April,	1	1	1	1	4	11	4	-	0.25	63
1877-1901	1	1	1	1	4	11	4	-	0.25	64
"	1	1	1	1	4	11	4	-	0.25	1810.89

BRIGHTON AND HOVE NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 12th June, 1902.

Dr.	Cr.	£ s. d.	£ s. d.
To Balance in the hands of the Treasurer, 13th June, 1901	... 20 11 2	... 20 11 2	... 6 3 9
" Annual Subscriptions to 1st October, 1901	... 10 0 0	... 10 0 0	... 0 10 6
" Annual Subscriptions to 1st October, 1902	... 57 10 0	... 57 10 0	... 12 0 6
" Entrance Fees .....	... 3 10 0	... 3 10 0	... 4 4 8
" Dividends on £100 2 <i>½</i> per cent. Consols for one year ...	... 2 15 0	... 2 15 0	... 6 13 0
	... ... ...	... ... ...	... 10 0 0
			... 2 1 2
			... 2 2 0
			... 2 5 0
			... 3 0 0
			... 18 18 5
			... 2 10 11
			... 1 4 6
			... 22 11 9
			<hr/>
			£94 6 2
Balance brought over ...	... ... ...	... ... ...	... 22 11 9

NOTE.—There is a sum of £100 2*½* per cent. Consolidated Stock standing in the names of the Hon. Treasurer and Hon. Secretary and Mr. E. A. PANKURST as Trustees for the Society.

BOTANICAL.

The following plants have been added to the Society's Herbarium since 1901 :--

Poa bulbosa.	Brighton Racehill.
Eriophorum vaginatum.	Amberley Wildbrooks.
Vaterianella dentata, b. mixta.	Clayton.
Potamogeton obtusifolius.	Barcombe.
Crepis setosa.	Newmarket Hill Road.
Silene dichotoma.	Rottingdean.
Alopecurus fulvus.	Ashdown Forest.
Diplotaxis tenuifolia.	Newhaven.
Zanthium strumarium.	Kingston-by-Sea.

T. HILTON,
Curator.

RESOLUTIONS, &c., PASSED AT THE 49th ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Librarian's Report be received, adopted, and printed for circulation as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“Mr. J. E. Haselwood, Dr. A. Newsholme, Mr. D. E. Caush, Mr. E. J. Petitsoult. B.A., F.C.P., Mr. J. P. Slingsby Roberts, Dr. E. McKellar, Deputy Surgeon General, J.P., Mr. A. G. Henriques, J.P., Dr. W. J. Treutler, and Mr. W. Clarkson Wallis.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. J. W. Nias and Mr. A. F. Graves.”

It was proposed by Mr. H. W. CHARRINGTON, seconded by Mr. H. DAVEY, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year :—*President*: Mr. E. Alloway Pankhurst; *Ordinary Members of Council*: Mr. W. W. Mitchell, Mr. E. Payne, M.A., Mr. F. R. Richardson, Mr. G. Morgan, L.R.C.P., Dr. R. J. Ryle, Mr. Walter Harrison, D.M.D.; *Honorary Treasurer*: Mr. E. A. T. Breed; *Honorary Librarian*: Mr. H. Davey, Jun.; *Honorary Curators*: Mr. H. S. Toms and Mr. T. Hilton; *Honorary Secretary*: Mr. J. Colbatch Clark, 9. Marlborough Place; *Assistant Honorary Secretary*: Mr. H. Cane.”

It was proposed by Mr. D. E. CAUSH, seconded by Mr. J. E. HASELWOOD, and resolved—

“That the best thanks of the Society be given to Mr. W. Clarkson Wallis for his attention to the interests of the Society as its President during the past two years.”

It was proposed by Mr. J. H. SUSSEX HALL, seconded by Mr. J. E. HASELWOOD, and resolved—

“That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curator, the Honorary Auditors, and the Honorary Secretaries, for their services during the past year.”

SOCIETIES ASSOCIATED

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society.

Boston Society of Natural Science (Mass., U.S.A.).

- British and American Archaeological Society, Rome.
- Cardiff Naturalists' Society.
- City of London Natural History Society.
- Chester Society of Natural Science.
- Chichester and West Sussex Natural History Society.
- Croydon Microscopical and Natural History Club, Public Hall, Croydon.
- City of London College of Science Society, White Street, Moorfields, E.C.
- Department of the Interior, Washington, U.S.A.
- Eastbourne Natural History Society.
- Edinburgh Geological Society.
- Epping Forest and County of Essex Naturalist Field Club, West Ham Institute.
- Folkestone Natural History Society.
- Geologists' Association.
- Geological Society of Mexico.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- Leeds Naturalist Club.
- Lewes and East Sussex Natural History Society.
- Maidstone and Mid-Kent Natural History Society.
- North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells Bladen, Secretary).
- Nottingham Naturalists' Society, Hazlemont, The Boulevard, Nottingham.
- Peabody Academy of Science, Salem, Mass., U.S.A.
- Quekett Microscopical Club.
- Royal Microscopical Society.
- Royal Society.
- Smithsonian Institute, Washington, U.S.A.
- South Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Southport Society of Natural Science, Rockley House, Southport.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- Watford Natural History Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS
OF THE
Brighton and Hove Natural History and
Philosophical Society,
1902.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton.

ORDINARY MEMBERS.

- ABBEY, HENRY, Fair Lee Villa, Kemp Town.
- ASHER, Rev. F., 33, Clifton Terrace.
- ASHTON, C. S., 10, Powis Grove.
- ATTREE, G. F., 8, Hanover Crescent.
- BADCOCK, LKWIS C., M.D., M.R.C.S., 10, Buckingham Place.
- BEVAN, BERTRAND.
- BEVAN, A. S. B., Coolavin, Harrington Road.
- BILLING, T., 86, King's Road.
- BOOTH, E., 53, Old Steine.
- BREED, E. A. T., 32, Grand Parade.
- BROWN, J. H., 6, Cambridge Road, Hove.
- BROWN, GEORGE, Cottesmore, The Upper Drive.
- BULL, W., 75, St. Aubyns, Hove.
- BURROWS, W. S., B.A., M.R.C.S., 62, Old Steine.
- BURCHELL, E., L.R.C.P., 5, Waterloo Place.
- CARTER, F. W., 47, Buckingham Road.
- CANE, H., 173, Ditchling Road.
- CATT, REGINALD J., 28, West Hill Street.
- CAUSH, D. E., I.D.S., 63, Grand Parade.
- CHARRINGTON, H. W., 23, Park Crescent.

- CLARK, J. COLBATCH, 9, Marlborough Place.
 COLMAN, Alderman J., J.P., 14, King's Gardens, Hove.
 COX, A. H., J.P., 35, Wellington Road.
- DAVEY, HENRY, J.P., 82, Grand Parade.
 DAVEY, HENRY, Junr., 82, Grand Parade.
 DENMAN, S., 26, Queen's Road.
 DODD, A. H., M.R.C.S., L.R.C.P., 45, St. John's Terrace, Hove.
 DRAPER, Dr., Municipal School of Technology.
- EDMONDS, H., B.Sc., Municipal School of Technology.
 ELGEE, E., Mountjoy, Preston.
 EWART, Sir J., M.D., F.R.C.P., M.R.C.S., F.Z.S., Bewcastle,
 Dyke Road.
- FLETCHER, W. H. B., J.P., Bersted Lodge, Bognor.
- GILKES, J. H., 6, Hanover Crescent.
 GRAVES, A. F., 9A, North Street Quadrant.
 GRIFFITH, A., 59, Montpelier Road.
 GROVE, E., Norlington, Preston.
- HALL, SUSSEX J., Ship Street.
 HANNAH, I.
 HACK, D., Fircroft, Withdean.
 HARRISON, W., D.M.D., 6, Brunswick Place, Hove.
 HASELWOOD, J. E., 3, Richmond Terrace.
 HAYNES, J. I., 24, Park Crescent.
 HENRIQUES, A. G., F.G.S., J.P., 9, Adelaide Crescent, Hove.
 HICKLEY, G. 92, Springfield Road.
 HILTON, T., 16, Kensington Place.
 HOBBS, J., 62, North Street.
 HOBHOUSE, E., M.D., 36, Brunswick Place, Hove.
 HOLDER, J. J., 8, Lorne Villas.
 HORTON, W. T., 42, Stanford Road.
 HOWLETT, J. W., 4, Brunswick Place, Hove.
- INFIELD, H. J., Sylvan Lodge, Upper Lewes Road.
- JACOMB, Wykeham, 72, Dyke Road.
 JENNER, J. H. A., Lewes.
 JENNINGS, A. O., LL.B., 11, Adelaide Crescent, Hove.
 JOHNSTON, J., 12, Bond Street.
 JONES, J. J., 49, Cobden Road.
 LANGTON, H., M.R.C.S., 11, Marlborough Place.
- LAW, J., Crosthwaite, Lewes.
 LEWIS, J., C.E., F.S.A., Fairholme, Maresfield.
 LOADER, KENNETH, 5, Richmond Terrace.

- McKELLAR, E.**, Deputy-Surgeon-General, M.D., J.P., Woodleigh, Preston.
- MAGUIRE, E. C.**, M.D., 9, Old Steine.
- MAY, F. J. C.**, 25, Compton Avenue.
- MERRIFIELD, F.**, 24, Vernon Terrace.
- MILLS, J.**, 24, North Road.
- MITCHELL, W. W.**, 66, Preston Road.
- MORGAN, G.**, L.R.C.P., M.R.C.S., 6, Pavilion Parade.
- MUSTON, S. H.**, 54, Western Road.
- MCPEHRSON, T.**, 4, Bloomsbury Place.
- MANSFIELD, H.**, 11, Grand Avenue, Hove.
- NEWMARCH, Major-General**, 6, Norfolk Terrace.
- NEWSHOLME, A.**, M.D., M.R.C.P., 11, Gloucester Place.
- NIAS, J. W.**, 65, Freshfield Road.
- NICHOLSON, W. E.**, F.E.S., Lewes.
- NORMAN, S. H.**, Burgess Hill.
- NORRIS, E. L.**, 8, Cambridge Road, Hove.
- PANKHURST, E. A.**, 3, Clifton Road.
- PARIS, G. DE**, Norfolk Road.
- PAYNE, W. H.**, 6, Springfield Road.
- PAYNE, E.**, Hatchlands, Cuckfield.
- PENNEY, S. R.**, Larkbarrow, Dyke Road Drive.
- PETITFOURT, E. J.**, B.A., F.C.P., 16, Chesham Street.
- PUGH, Rev. C.**, 13, Eaton Place.
- PUTTICK, W.**, Brackenfell, Hassocks.
- POPLEY, W. H.**, 13, Pavilion Buildings.
- READ, S.**, 12, Old Steine.
- RICHARDSON, F. R.**, 10, Vernon Terrace.
- ROBERTS, J. P. SLINGSBY**, 3, Powis Villas.
- ROBINSON, E.**, Saddlescombe.
- ROSE, T.**, Clarence Hotel, North Street.
- ROSS, D. M.**, M.B., M.R.C.S., 9, Pavilion Parade.
- RYLE, R. J.**, M.D., 15, German Place.
- SALMON, E. F.**, 30, Western Road, Hove.
- SAVAGE, W. W.**, 109, St. James's Street.
- SLOMAN, F.**, 18, Montpelier Road.
- SCOTT, E. IRWIN**, M.D., 69, Church Road, Hove.
- SMITH, C.**, 47, Old Steine.
- SMITH, T.**, 1, Powis Villas.
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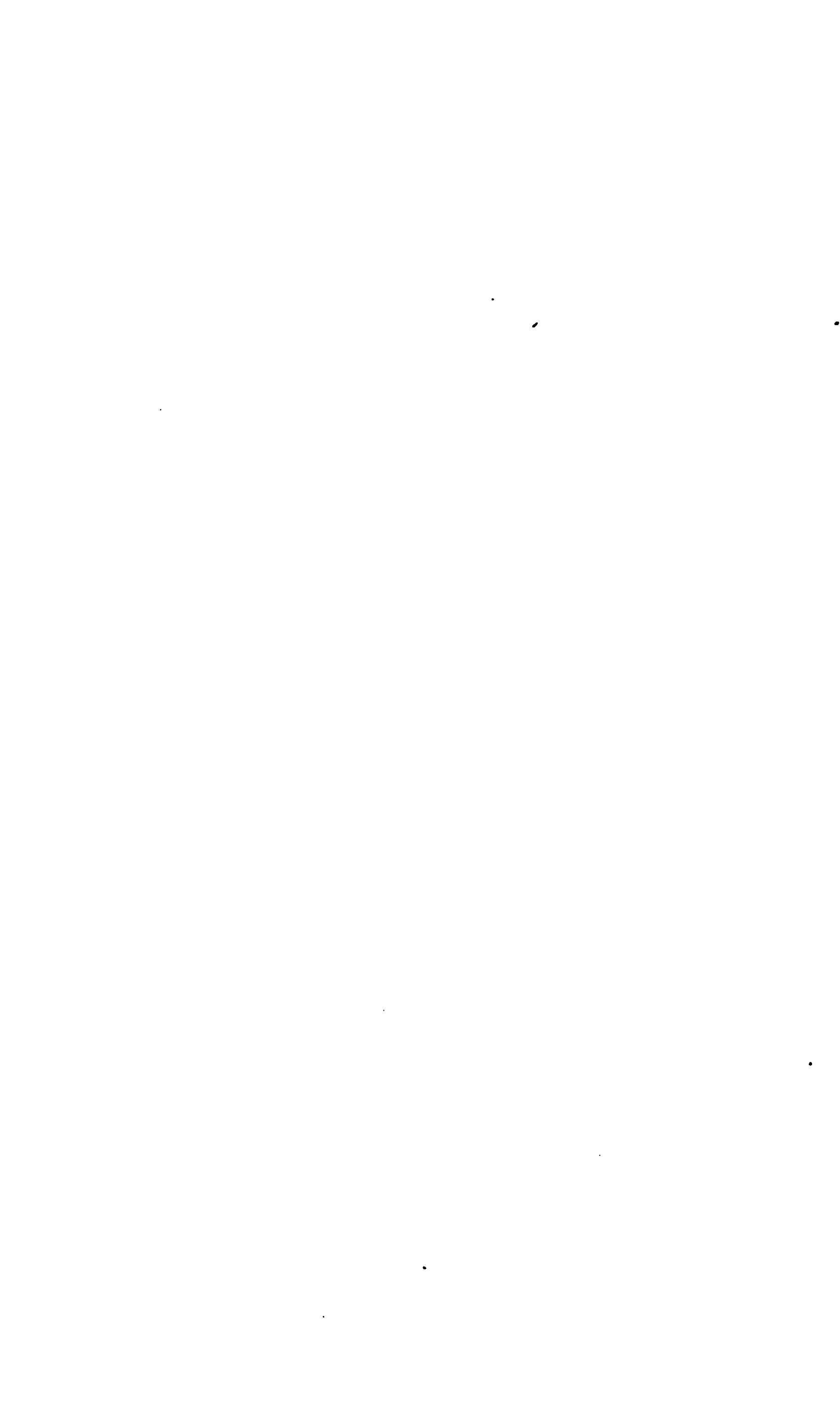
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Progress—and Its Illusions.

OCTOBER 8TH, 1902,

BY

THE PRESIDENT,

E. ALLOWAY PANKHURST.

"If we carry our thoughts as far forward as palæolithic implements carry them back, we are introduced not to an absolute optimism but to a relative optimism. The cosmic process brings about retrogression as well as progression, where the conditions favour it. . . . Evolution does not imply a latent tendency to improve—everywhere in operation. There is no uniform ascent from lower to higher, but only an occasional production of a form which in virtue of greater fitness for more complex conditions, becomes capable of a longer life of a more varied kind."—HERBERT SPENCER: "Principles of Sociology," Vol. III., p. 599.

About forty years ago was published Buckle's "History of Civilization."

The author in a final survey of the vast field of his researches allows that the age, "which was in nearly all respects greater than any the world had yet seen," yet "had a certain material unimaginative and unheroical character, which has made several observers tremble for the future." "But," he adds, "I do not participate in these fears because I believe the good we have already gained is, beyond all comparison, greater than what we have lost." This I think fairly represents the view of the advocates of progress.

Mr. Darwin again, at the conclusion of that great work, "The Origin of Species," as if to give us some relief from the sombre details of that long tragedy which he terms "the struggle for existence," consoles us with the reflection that, "as

natural selection works solely by and for the good of each being, all corporeal and mental endowments would tend to progress towards perfection."

That was so in harmony with men's desires, hopes, and aspirations, that it half justified his theory of evolution.

If Progress be not a faith, a belief,—it must approve itself to the reason ; it must be an inference from undeniable facts ; it must command assent from all by virtue of incontestable proofs. It behoves us, therefore, to endeavour to obtain some exact definition of progress, to discover what conceptions are involved in it, what images it calls up, what ideas are implied.

If a body be moving in an orbit, a circle, or an ellipse, in fact in any curve which is closed or returns into itself, we speak of it as *pro*-gressing or *re*-gressing according as we imagine that it moves from us or to us. I say *imagine*, for in a closed curve the movement *from* us is just as much a movement *to* us. A friend sets out on a journey round the world. Every mile he travels from the starting point brings him a mile nearer home. Whether he may be described as "going from" us or "coming to" us may afford matter for discussion—as similar problems have so often done before. Progress and regress then merely express a manner of looking at the object we are contemplating. The terms have reference to our position, our point of view, perhaps, to our predilections or fancies. "A circular motion" says Lord Bacon, "hath much the appearance of a progressive one."

And further, our language and the notions and ideas it expresses with regard to *direction* are also misleading and deceptive. They are no more conformable to the truth of things than our ideas of motion. We speak of the sun and moon being *above* us. We think of the stars seen by our antipodes in New Zealand as being *below* us. But Nature knows nothing of high or low. These are illusions ; illusions which, such is the strange problem in which man's mental constitution is involved, that he is obliged continually to accept as truth and reality.

But there is something more than mere *motion* involved in the word progress, as generally used. It implies not movement only, but movement from a lower plane to a higher one ; from a less good to a better condition ; from a simple to a more complex organization. Nay, more, in its general acceptation it implies a gain uncompensated by any loss. If equivalent payment is made for an advantage obtained, then progress is robbed of its meaning. The word has no longer any charm for us.

But these expressions,—high, low, good, better, &c.,—which we use to indicate progress, have a moral rather than a physical significance, and as such are incapable of exact definition. They vary with the ever-varying opinions of those who use them. Who is the judge of what is good ? Is there an absolute good

by which we can measure these successive states, a standard on which all men are agreed, to which we can refer our estimates of value? And with regard to "low" and "high." What is the base from which we start, the scale by which we are to measure?

But leaving now these abstract considerations, let us take some concrete examples of progress, trusting these will help us where philosophical definitions fail.

The word is the common property of the politician, the sociologist, and the historian. And not only of the historian who chronicles the succession of events which make up the records of humanity, but of him, also, who depicts for us the great drama of unfolding life which preceded the advent of man on the globe.

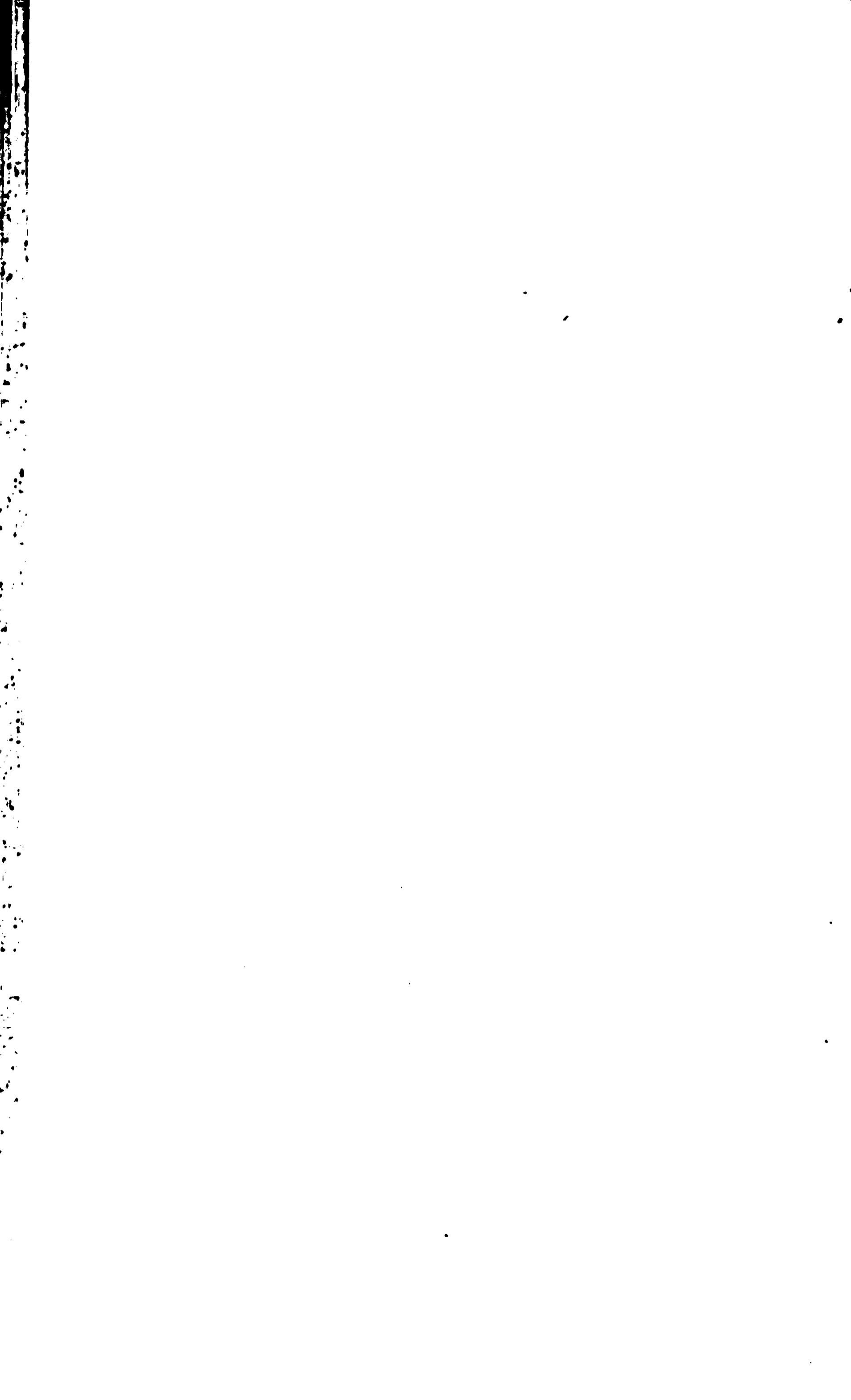
The geologist deciphering the records of that vast series of rocks which compose the crust of the earth becomes aware of a great multitude of forms of life which have passed away. He tells us that the deepest rocks contain only the remains of those animal and vegetable species which are lowest in the scale of being, and that as we approach the latest strata the dominant forms of any successive epoch are those which mark the steps in the biologists' ascending scale of life.

He speaks of the fierce and active Molluscs of the Silurian, of the armour-clad Fish of the early Devonian or the more perfect fish of the Permian; then of the Amphibians of the Carboniferous. This was a notable step in advance, for the land animal, whose conditions of existence are more varied than those of one confined to the sea, has corresponding difference of structure. Limbs more diverse in form, organs of nutrition adapted to the more complex nature of food, lungs with their myriad interstices replacing gills, the blood warmer, heart more complicated, senses more acute, nerves more intricate, brain more developed.

Next he passes to the huge fish-lizards of the Lias, and then to the great Reptiles of the Oolite, to the gigantic land lizards of the Wealden, to the Birds of the Cretaceous, and finally to the Marsupials and Mammals of the Tertiaries,—the gigantic pre-decessors of the quadrupeds which exist to-day.

Tracing thus the source of life from the first speck of protoplasm that was engendered in the muddy waters of primeval seas,—from that first combination of cells that gave a feeble response, in dull unconsciousness, to the stimulus of a ray of light, or wave of heat, up to man, sensible to all the subtle influences of space and time,—how vast the interval that has been bridged!

Progress is easily discerned if we do not take into account the compensation exacted for it, if we ignore the necessary conditions of its presence; if we shut our eyes to the sacrifice



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it entails, and the cost at which it is purchased. Nature *gives* us nothing. This, too, is bought at a price.

The Palæontologist, as he writes the history of the great dominant forms of life that at successive epochs have held sway on the earth, or stood as the representatives of the highest organization of their time, continually makes use of such terms as these :—“No sooner had this species attained its maximum of size and power than it was trampled out of existence by more virile races in the conflict of life.” “It attained its highest point, became most specialized, just before it disappeared.” Have we then at last arrived at a definition of Progress from a study of Palæontology and shall we put it thus : “The acquisition by any organism of these properties and qualities which ensure its extinction.” It is one at any rate which seems justified by the conclusions of Science, one in conformity with the lessons of Geology. It is the other side of the shield which is not so often presented to our view.

Looking again at that brief sketch of the course of life on the globe, let us see if in any other respects it may be illusory. It is deceptive if it suggests that all forms of life took part in this advance, that none fell behind in the race, that none were stationary, that none were degenerating. It is illusory in so far as it fails to bring before us these facts :—

1. That, co-existing with these higher forms of developing life, there were comparatively non-progressive forms. We may speak of some of these also as types of *arrested development*.

2. That, together with progressing forms, there were species which were degenerating and passing out of existence.

3. That at any epoch its most highly developed forms of life were a small portion of the total life of the globe.

4. The picture is misleading in so far as it represents that the higher forms of any epoch had their origin and genesis in the highest types of the preceding one.

5. Lastly, and this is the most important of all, it is illusory if it implies that there is *an absolute scale of life* to which all forms of existence may be referred, and by which their place and rank may be determined.

Regard the infinite multitude of existences which make up the world as we see it around us to-day, from the simple cellular structures of microscopic size, which constitute “the green mantle of the standing pool,” up to the creature who might realize our ideal of being but “a little lower than the angels”—all forms of life that have ever existed are, in a manner, represented.. Many species have undergone no appreciable modification since they first appeared in Cambrian or Pre-cambrian times. Untold millenniums have passed by and

left them unchanged. The Foraminifer which has formed our chalk hills, and whose shells are found in the earliest stratified rocks, is still laying at the bottom of the Atlantic, the foundation of "continents to be." The Lingula of the Silurian is still to be discovered in the sea, not far from our own shores. And lower and more persistent forms than these may be found, which seem never to have entered on the fatal path of progress. Some have gone further on the road than others, and remained stationary there, incapable of further advance. Their development, we say, has been arrested. The Beryx of the South Atlantic differs little from the Beryx whose remains are so finely represented in the Willett Collection of Chalk-Fossils in the Museum. And there is at least one species of fish which, as far as the minutest observation can perceive, has remained unchanged through all the vast period that has intervened between the present time and the Devonian.

It would not be too much to say that, in every epoch, the great mass of life is made up of non-progressive forms, and of those which only reach a comparatively little way on the road of development.

More and more Palæontologists are beginning to recognize that degenerate forms are to be found in every geological division, and *more particularly are they noticeable in those later stages of the earth's history, which are distinguished by the presence of higher and more complex forms of life.* Dr. Smith Woodward, our highest authority on the subject, in his "Outlines of Vertebrate Palæontology," speaks of "irreversible lines of progression and irreversible lines of degeneration."

And is there any evidence, it may be asked, in the existing fauna and flora of this degeneration?

The tiny Hyrax is but a poor representative of its great rhinoceros-like ancestor. The huge Python and the little Slow-worm show on dissection the aborted limbs which their lizard-like progenitors possessed. The Whale, with its mouth furnished with that curious "baleen" (known as whalebone), has the milk teeth, which connects it with a higher type. The Slugs of our garden carry beneath the skin the rudiments of a shell which they have no longer the power to produce. The list might be extended, and that to a far greater length than the text-books warrant. And it is illustrative of my argument that it is but a small fraction of the works on Zoology which devote any space to degeneration. Men's minds are set on *pro*-gress and not on *re*-gress. But the evidence for the one must be as strong and ample as for the other.

"Sufficient appearances," says Burke, "will never be wanting to those who have a mind to deceive themselves." And have we not all of us "a mind to deceive ourselves" when progress is in question?

4. *The highest forms of one epoch have not had their origin in the highest forms of the preceding epoch, nor have they given rise directly to the highest forms of the succeeding one.*

Nothing, then, could be further from the truth than that the dominant species that characterise successive epochs of the world's history are linked to one another in a continuous uninterrupted series. Nature knows nothing of such a serial progression. It exists only in idea. There is no linear arrangement of higher or lower forms. All forms are connected, undoubtedly, but if it be possible to represent or picture to ourselves the method and manner in which they are linked together *in space of two dimensions*, it must be under the figure of a tree.

Now this picture of a growing tree implies a principle and method of such great importance in the evolution of life in all its forms, and in all its manifestations, that it will be advisable perhaps to adduce some illustrations of it. It is useful in many respects; but there is danger that, if its analogies are pressed too far, we may be led into error.

The bird we may say is higher and comes later in time than the reptile. But if we may follow back their ancestral genealogies they will gradually approach one another as we recede, until we come to a point where the branches unite nearer the trunk, and bird and reptile are one. The lowest reptile and the lowest bird are nearly allied.

Animals are divided, as you know, into two great kingdoms of Vertebrates and Invertebrates. But the highest Invertebrate has not given rise to the lowest Vertebrate. In going down the main branch of the Vertebrates we pass by as it were the highest point of the branch representing the Mollusc, and find a relationship between them far indeed towards the base of that tree from which they both seem to spring.

It is one of the most interesting of researches, this of the genealogy of life. But the record is often broken, and we seek in vain for some evidence of the earlier course which a genus or species has followed. Palæontology, like human history, has its "dark ages." The records of the past bear witness to the deep pulsations of the great heart of the world, to the ebb and flow of the tides of the great ocean of life. There are periods when the creative power is comparatively dormant, and again those when its energies gradually rise to their full scope, and attain their highest point. It is as the oscillation of the pendulum, the swing of the earth in its orbit, or the alternations of sunlight and shadow on its surface. The morning and evening of the world's first day, symbols of activity and rest, are repeated in larger periods of rhythmic change throughout the countless millenniums of its past.

We have still been using these conventional terms, "high," "low," "nobler," "more perfect," &c., to indicate that progressive development of organic life, without deciding what principle shall guide us in their application. This is really the most important part of our subject. All conceptions of progress are based on it. We have said that there is no linear succession of advancing forms, that is to say, they cannot be truly depicted in a straight line. But even if we look at the plan of nature under the image of a tree that will not help us in our present quest. We cannot conceive of a tree without giving to it some altitude as a whole, and generally picture it with branches of varying height.

The branches of our imaginary Tree of Life are made up of different families or genera each with numerous species. How is the place of each species that helps to make the branch decided? Which is to be put above, which is below another? What is the measure of value?

There are two lines of inquiry which commend themselves to the systematist,—function and structure.

Seeing that estimation of function is beyond us, let us try how far classification by structure will help us in the solution of the problem.

Let us take function first, and in doing so consider man as the head of creation, and to be such by virtue of his intelligence, or, more broadly, by his nervous and cerebral activity. If, therefore, we take this, as Lamarck did, as the basis of classification, and if we could arrange all animal life in a descending scale from man, then we should have a measure of general application to all its forms. But this is impossible. There is no measure of such manifestations of vitality. Besides, it totally excludes the vegetable kingdom. There is no nervous activity here to measure. Plants are accumulators of power, not expenders.

Structure is, to a large extent, an index of function. Complex structure implies varied functions. Knowing the structure of an organism which can, to a great extent, infer its functions.

There is a large class of animals of infinite variety of colour, size, and outward form all possessing a backbone. Moreover, there are many structural details which are always associated with this backbone which terminates in a skull. The digestive system is on one side, the nervous on the other. The chain of vertebræ enclose a spinal cord, the muscles are attached to an osseous frame-work, the limbs are variously modified, &c. Thus the Vertebrates, we say, form a great natural class.

Looking again at a vast number of other creatures, we find them built up on quite a different plan. There is no backbone, the so-called skeleton is simply a hardened skin, the limbs are hollow tubes leading from the cavity of the body. The

nervous system is formed of a chain of separate rounded masses, connected together by thin cords, and the whole nervous system lies in the part of the body nearest the ground. These are classed as Invertebrates. Now the Vertebrates, having more highly-developed organs, bringing them into more varied relations with the external world, having a more complete structure, more varied functions, are placed above the Invertebrates. Consider for a moment the difference between a bird singing in the branches of a tree and a snail crawling in the grass beneath. How vast the interval between them ! What an illustration, we say, of the great scheme of the world's development, and of the steps in its progressive life, for the Vertebrate is higher than the mollusc and comes later on the scene. This is too partial a view. Reckoned among the Vertebrates is a pale, ghost-like creature, with a mere apology for a backbone, without a brain, with scarcely any organs of sense, whose dull monotony of existence is only broken by faint variations of light and shade as it roams among the mud and weeds of the shallow estuary in which its existence is passed. Compare this with the bee, winging its way in the sunshine, sensitive to the odour and colour of flowers, with faculties seemingly more than human in their co-ordination to the unconscious ends and aims of existence. Teaching also in the subordination of individual liberty to the welfare of the community, "The act of order to a settled kingdom." Which shall we reckon the highest in the scale of life, the lancelet or the bee ? The celebrated Von Baer thought the bee more highly organized not only than this specimen of one of the lowest orders of fish, but than any member of the whole class of fishes.

Yet the Vertebrate, we have said, is higher than the Invertebrate ! Does structure then measure life ? This is not a solitary instance ; it is but a type of the difficulty which meets the systematist on every side. Supposing we take only a branch of our Tree of Life, and endeavour to place the groups which compose it, or the individual of the groups, in serial rank, how is he to proceed ? "By noting," we are told, "the points of structure which are fundamental and essential." Yes, but what to one classifier is fundamental and essential, to another is not. Different observers place different values on the same structure.

In that endless mutation of form which the kingdom of the Invertebrates presents to us, there is a vast number of groups whose relationship to one another cannot even be represented in space of two dimensions. Only with length, breadth, and depth can we picture to ourselves these cycles within cycles in endless complexity. If, then, this obtains in the Invertebrate kingdom, is it not a presumption that the orders, families, species, etc., of the Vertebrates should be regarded in the same manner ? We must give up our "Tree of Life." The picture is illusory. It implies

that there is a measure of its height, a serial gradation in the groups forming its branches. In a remarkable passage in "The Origin of Species," Mr. Darwin, himself investigating the subject we have been considering, expresses himself in the language of the astronomer, and recalls to us the suns and circling planets and systems of worlds which in bewildering multitudes stud the infinitude of space. These are his words: "The several subordinate groups in a class cannot be ranked in a single file, but seen clustered round points, and these round other points, and so on, in endless cycles."

To sum up the argument, then, in a few words, Naturalists of repute refuse to allow that there is any arrangement of forms of animal life based on claims to superiority, no serial progression from less to more perfect.

If this be the case, what becomes of any *Criterion of Progress* as far as the animal and vegetable world is concerned?

For in what sense can we say that the fish is more perfect than the insect, the reptile than the fish? All that we can affirm is that each is admirably adapted to the conditions of its existence. It is evident that the idea underlying such use of the words, "more *perfect*," when applied to the successive types which indicate the course of animal development, is their approach to man in their structure and their functions.

But is not this the same anthropomorphic idea which we are so often told vitiates so many of our conceptions of the world, its origin, and its government? Is this principle only to be retained here and discarded elsewhere? Is man in all respects the most perfect being of creation? Are there no qualities in which the so-called lower organisms are his superiors? Are there none with senses more acute, none with nerves transmitting more delicate waves of motion, none with instincts more marvellous even than his reason,—as attaining its ends without the laborious process of thought? But it may be said that man is superior by his intellect. Is the most intellectual man always and everywhere the highest, the most perfect?

Yet there is one more test of rank, one principle which Biologists invoke to decide the place of any organism in the hierarchy of life. The higher organization, they say, is that in which the parts are more specialized. It is one of exceedingly wide, almost universal, application, and it behoves us, therefore, carefully to examine it. It is our last hope of obtaining that scale and measure we are in search of.

They define Specialization to be the setting apart certain portions of an organism to perform certain particular functions. This has happily been termed, by Milne Edwards, "*the physiological division of labour.*"

"Is not this progress, then?" It may be asked, Is there not here a measure of rank?

But, supposing that interdependence of parts, this complexity of structure militates against the permanence of the whole? Suppose it narrows the conditions, makes it less able to bear the shock of opposing circumstances under which the organism can exist, and so render it less able to compete advantageously with less specialized organisms in the struggle for life?

Did we not see that the palæontologist declares that, as soon as a species attained its highest degree of specialization, it disappeared from the earth?

Specialization in itself is not indicative of perfection, or progressive development, or superiority. It only means that an organ has been modified, so as to adapt its possessor to particular conditions of existence. The ancestors of the horse had five toes as we have. In process of time, four toes atrophied, and the nail of one became developed into a hoof. But a hoof is not a higher type of structure than a foot, nor is it indicative of a nobler animal. Put a horse among bogs or swampy ground, and its one-toed foot would be a disadvantage,—might entail its destruction. The area on which it can exist is now limited to comparatively *hard* ground.

Specialization cannot, then, always be taken as a criterion of progress, for it may be characteristic of degeneracy.

Granted that the process of development is from the simple to the more complex, *is the more complex always the more perfect?* Are there no categories in other departments of life in which the highest from one point of view is not the highest from another? Are not the simple and the lowly nearer the great centre and origin of life and larger participants in its power? In estimating the rank of the groups into which we divide the lower organisms, as we term them, one quality particularly seems to me to have been lost sight of,—that of duration. It is a problem connected with *Time*, and many problems are insoluble if *Time* be left out of account. There is given to each individual at birth a certain *quantum* of life. This may assume an active or passive form. It may maintain the vegetative unconscious life of the organism through long years practically unimpaired, or it may be expended in conscious activities in a decade. And so with those groups of organisms we have been considering with varying periods of existence. In dealing with individual human life we count length of days as implying some advantageous quality, and in families, long descent, or that principle of permanence in the blood is reckoned as giving them a claim to be among the aristocracy of the earth. What, then, are we to say of those structureless specks of protoplasm, such as the Foraminifera of the Chalk?—a genus of animals which through unimaginable ages has existed practically unaltered, and has played, as we have said, no mean part in the economy of the globe. Imagine that family to have a *memory*, a consciousness of its past! What

generations of nobler creatures it has seen age after age "come like shadows—so depart." It has outlived all the vicissitudes of existence which the earth has gone through. It has "read the book of fate," and seen "the revolution of the times"

"Make mountains level, and the continent,
Weary of solid firmness, melt itself
Into the sea."

And yet classification based on structure, to be logical, can find no place for such as these! Imagine the world when only these Infusoria or perhaps even lower types existed! Yet out of such structureless protoplasm the life of the earth has arisen. Out of this has sprung those kingdoms, classes, genera, orders, &c., which make up the complex world of vegetal and animal existences, group within group, cycle within cycle, recalling to us the clusters of stars and revolving systems which arose out of the diffuse nebula in which they were potentially contained. In that homogenous jelly-like protoplasm life also was *potential*. It has realised itself in the organisation and the resulting faculties and powers of all those countless forms in which that energy has embodied itself.

But the great law of the Conservation of Energy teaches us that when *potential* energy becomes *actual* the total quantity remains the same. There is neither loss nor gain.

Let us, then, like the great dramatist of Greece, strive "to see life steadily, and to see it *whole*,"—not as circumscribed by our own limited experience, not as measured by our own narrow faculties, not stamped with our own petty ideals of perfection,—but to see it from a higher standpoint, embracing a wider horizon, and in the scope of a larger vision.

THURSDAY, NOVEMBER 13TH.

British Oak Trees and the Galls found upon them.

(With Lantern Illustrations.)

EDWD. CONNOLD, F.E.S.

THURSDAY, DECEMBER 11TH.

Progress—and its Illusions.

Part II.

THE ARGUMENT from the HISTORY OF HUMANITY.

"Society never advances. It recedes as fast on one side as it gains on the other. It undergoes continual changes; it is barbarous, it is civilized, it is christianized, it is rich, it is scientific; but this change is not amelioration. For everything that is given something is taken. Society acquires new arts and loses old instincts. . . . If the traveller tell us truly, strike the savage with a broad axe, and in a day or two the flesh shall unite and heal as if you struck the blow into soft pitch, and the same blow shall send the white to his grave. . . . Society is a wave. The wave moves onward, but the water of which it is composed does not. The same particle does not rise from the valley to the ridge. The persons who make up a nation to-day, next year die, and their experience dies with them."—EMERSON.

JUST as Geology informs us that those dominant types of animal life characteristic of an epoch have gradually arrived at maturity and then quickly, almost suddenly, disappeared, so the historian of humanity shows us how large groups or communities of individuals, having a special character of their own, emerge from the general mass of humanity, attain to pre-eminence, and then pass away. They are ousted in the conflict of life by lower and more virile races. These social organisms become exhausted in the effort to produce that civilization which is their claim to remembrance. What is there in a great social organization inimical to its continued existence? What militates against the continuance of its life? The SOCIAL life is necessary for the development of humanity, necessary for the development of those finer feelings, for that larger knowledge which we take to be characteristic of progress. And yet the conditions, the NECESSARY conditions of this advance are fatal to the very organism which they have produced. Organization entails cost, says the physiologist, as he sees the wear and tear of the delicate machinery of life under the stress and strain of outward circum-

stances, and the extra nutriment which must be provided in consequence of the ever-increasing demands of the part which expends on that which produces. The higher intellectual life is antagonistic to the lower. There is no strain so great, no tax so heavy on the human constitution as nervous activity, but progress implies nervous and cerebral activity. Society perishes rapidly at the top ; it is constantly being recruited from lower strata. But this fountain of supply is not perpetual, and these at last become exhausted.

The distinguishing characteristic of a highly civilized society is the setting apart of certain of its groups of units to perform separate and particular functions. But "specialization implies loss of vitality." This is a great law of Biology, and Biology means the laws of life in general. It must apply to the social as well as to the bodily organism. The cell which in the lower organism performs all functions has then in the full exercise of all its powers what may be termed its absolute efficiency. But as it becomes a part of a higher animal it suffers limitations. It is modified to perform special functions. The settler in the backwoods ploughs the land, tends the cattle, reaps the corn, fells the tree, builds his house, &c. ALL his faculties are developed, but in the specialized labour of a civilized community twenty or thirty men of different occupations will be employed in building the house. The talents of each are limited to particular functions. Progress in the arts is thus bought at the price of curtailed faculties of those who are employed in them. The exaggerated development of some faculties involves the loss of others. There can be no Progress in one direction but implies Regress in another, or as Goethe expressed it : "In order to expend on one side Nature is forced to economize on the other ;" or as two Belgian *Savants* have put it : "*Degeneration is not an accident in evolution, it is the correlative of progressive evolution and the necessary complements of every transformation whether anatomical or social.*" Society demands the specialized individual, the one with some faculties atrophied, some organs which have more or less degenerated in order that others might serve it with greater effect. In the struggle for existence you have still the survival of the fittest, but the fittest is now no longer the rough burly backwoodsman but the individual with deft hands and narrow chest, with finer nerves, more delicate taste or abnormal brain. "Cells lose their vitality in proportion as they are specialized," says the Biologist.

The struggle for existence, which in the free play of individual action resulted in the survival of the healthiest, the strongest and the bravest, now under the limitations of the social organism, by a curious inversion of results, gives greater advantages to the weakly and the abnormally developed, to the **SPECIALLY** not the **GENERALLY** efficient.

Society says : "I will take care of your life, no one shall hurt you. I will take care of your property, you need make no effort in its defence." The manlier virtues disappear. Society is for the weak, not for the strong. Men become more and more dependent. Towns and great cities arise. But great cities are the destruction of the race. The conditions of a healthy life are absent from the excited mart, the bustling street, the crowded tenement. No society can progress without a leisured class ; that is to say, without that wealth, that reserve of potential energy of which capital is the embodiment. But wealth that brings such aids to progress is also an agent of destruction. The forces which create are those which destroy. The wealth which at one time may be invigorating in excess may corrupt. Comforts at first occasional become habitual. Luxuries become necessities. Pleasure becomes one of the main objects of existence. Education creates ideals which can never be realized, wants which can never be satisfied. Society creates in its midst a proletariat, not of labour and drudgery, but an intellectual proletariat, restless, dissatisfied, which chafes under any control, seeks to break all the bonds which hold society together, and rejects all commandments.

Again, progress in civilization implies those finer feelings, that more delicate sympathy which regards the sufferings and the wants of others, that humanitarianism which sustains the falling, feeds the hungry, and provides for the maimed and wounded in the battle of life. But every imbecile, every improvident, every unthrifty thus maintained at the expense of the community, is a tax on the energies of the strong, the industrious, and the healthy. You have saved, by your rates, or your contributions, a life of little or no value to the community, but you have made life harder, you have brought death nearer, to the very individuals by which the best life of the community is maintained.

"Owing to these general causes," says Mr. Francis Galton, in reviewing certain questions bearing on heredity, "there is a steady check in an old civilization in the fertility of the abler classes—the improvident and the unambitious are those which chiefly keep up the breed, so the race gradually degenerates, becoming with each successive generation less fitted for a high civilization, although it retains the external appearance of one; until the time comes when the whole political and social fabric caves in, and a greater or less relapse towards barbarism takes place.

THURSDAY, JANUARY 22ND, 1903.

A Naturalist's Ramble on the Sea Shore.

(With Lantern Illustrations.)

F. MARTIN DUNCAN.

(In this case as in others in which experiments or Lantern Illustrations form such an important part of the Lecture, it is impossible to give any adequate abstract of it without a reproduction of them.)

WEDNESDAY, FEBRUARY 18TH.

Travelling in Mid-Air,

BY

MR. ERIC STUART BRUCE, M.A.

AT the outset Mr. Bruce dwelt upon the great developments of aerial navigation of late years, and in particular alluded to the way in which the operations of the late war had silenced the criticisms of those who grudge national expenditure on aerial navigation. Referring to some of the tragedies with which recent advance in aeronautics has been marked, Mr. Bruce said that temporary failure, and even the martyrdom of brave men in the cause of science, could not stop the natural law of progress, and the first British airship had crossed the Metropolis from the Crystal Palace to Harrow, without hitch or accident of any kind.

Then the lecturer came to some experiments. War balloons, he told his audience, were made of gold-beater's skin, which, however slight it might appear, was an admirable substance for the

purpose, because of its lightness, and its capacity for holding gas. Strength could be obtained by combining layers of the substance by an ingenious arrangement devised by the Royal Engineers. One or two miniature balloons of different sizes were quickly filled with gas from a compressed gas cylinder, and released by the lecturer, to sail up to the roof of the Banqueting Room at the end of a bit of string. To show how the perforation of a balloon by bullets would not necessarily mean disaster, if the perforations were in the lower part, Mr. Bruce pricked one of his bigger models with a lady's hat pin. Though with this weapon he repeatedly stabbed the balloon, it continued calmly to ascend. At Ladysmith, he said, a war-balloon was actually brought down by a shell, but it came down so gently that there was no inconvenience at all to the officers in it.

From the balloons themselves Mr. Bruce went on to illustrate a system of signalling by means of illuminated balloons, a system of his own invention which, he said, had been adopted by the British, Belgian, and Italian Governments, and he pointed out how useful balloon signalling might be in the case of ships distant from each other at sea, for detachments of an Army separated on land, and for polar exploration. The next experiments shown to the audience showed the action of aerial screws, the means by which at present most aeronauts are seeking to solve the problem of really navigating the air independently of the direction of the wind. One of the most interesting of the experiments, and one which called forth the hearty applause of the audience, was the releasing of a model of the Santos-Dumont steerable balloon, which, propelled by a little screw, made a circle gracefully in the air, and a trip to the big central chandelier and back, a few feet over the heads of the spectators.

In order to navigate the air, it was of the greatest importance to improve our knowledge of the numerous aerial currents at different altitudes. The disastrous results that may attend aeroplanes from these currents were illustrated experimentally by the convolutions in the Banqueting Room of a little flying machine. Mr. Bruce announced that, with a view to solving if possible some of the difficult problems connected with air currents above 3,000ft., arrangements were in progress for holding at an early date a great international kite-flying competition. The experiments, which would probably take place near Brighton, were likely to prove the most important of the kind in the history of aerial investigation.

In conclusion, Mr. Bruce expressed his increasing conviction that the conquest of the air, when it was achieved, would be achieved along the lines of a natural simplicity.

THURSDAY, MARCH 19TH.

MR. BENJAMIN KIDD'S

**The Principles of Western Civilization,
A Criticism and a Review,**
BY
THE REV. F. ASHER.

AS to the class of literature to which *The Principles of Western Civilization* belongs, Mr. Asher remarked that we are familiar with the treatment of life which consists in looking at the facts, and using common sense, and working up through facts to the principles which, as far as we can see, indicate the order in which facts are given to us. We know the scientific habit of mind, and this book is certainly not scientific. We are familiar with the method which treats not so much of facts as of thoughts, the method of Kant, and men of his stamp, who teach us not so much what the facts actually are, but tell us the conditions under which knowledge is possible. We know the philosophic habit of mind and the class of literature which deals with facts, not by working up from them, but by working down to them in the light of first principles. There is a gulf between these two habits of mind, between which war has been and is still being waged. But this book is not a philosophic book. It belongs to another class of literature, which deals not so much with facts and thoughts, as with that difficult and mysterious factor which we call life, which no one yet has analysed, which no one pretends to understand, but which is for ever facing us, inviting us to ascertain it, and eluding us; and which life can only be grasped by those men who are seers, and see into the life of things, and express their *aperçus* in the form which we may call apocalyptic. The characteristic of the apocalyptic type of literature, of which we have an exponent in Thomas Carlyle, is that it endeavours to grasp that which the man admits eludes him, the source of all facts—*life*. The scientific man deals with what he can observe; the philosophical man seems to grasp a higher type of fact; but the seer invariably feels himself invited, and almost oppressed by the sense of a

growing sentient life, and in his apocalypse gives us not so much the past, which the scientific man can talk about ; not the present which the philosophical man sees ; but the future, which unrolls itself before his eyes.

In considering the problem to be solved in the discussion of *The Principles of Western Civilization*, we must first gain some clear view of the drama of human action as it unrolls itself before our eyes on the page of history, and in order to do this we must be willing to seize the salient points and work from these, discovering as far as we can the principles which were at work when this particular salient point was flung out from the mountain range of human action, and trying as far as we can to relate the various peaks we see standing out before our eyes.

Can there be any real doubt that in the civilization of the western world there have been two great agencies at work, which can be indicated by the terms "the Roman Empire," and "Christendom?" Of course we may trace back the enormous range of life which died up into the Roman Empire. We may trace back from Egypt, Babylon, Assyria, Persia, Greece, till we come to Rome, and we may find in Rome the elements drawn out of the long struggle of race against race ; but we come to this fact at last, which Gibbon makes clear to us : that at one period of the human race all the fairest tracts of the best part of the western world, and all the power which was being worked out in the lives of men, was concentrated in that organisation known as the Roman Empire ; and by a wonderful process the powers which had specialised themselves became united in the person of one single man, and at a particular date,—say 27 B.C., after the Battle of Actium,—we have the marvellous spectacle of the whole of the countries surrounding the Mediterranean being governed by principles which found as their exponent one single man, the Emperor of Rome. That surely represents to us one of the great agencies which has been at work in the civilization of mankind.

Now if we move on through the centuries, and pass from the striking figure of Augustus to a typical mediæval figure,—say Dante,—what do we find? Is there any essential difference between those principles working in the heart of a representative man like Dante, and those which we found culminating in the character of a man like Augustus? Take his *Divina Commedia* and his other works, and we find we are in a different world. That solitary, exiled man carries within himself another principle, which seems to present a more potent and far-reaching influence than anything we can find in the time of Augustus. By about the year 1300 A.D. a new principle had found its way into those civilising principles which had hitherto been at work, and it could never thenceforth be rejected. Strong men cannot live without it ; it has come to form a part of the very fibre and tissue of their souls.

There are the two salient points—Augustus, summing up the tendencies of the Roman Empire ; and Dante, summing up, if not the tendencies, the best expression of the tendencies of Christendom. The problem is, how to relate those two salient peaks in the vast amount of human endeavour and achievement, so as to show that there is a connection which will indicate the principles which are working out in life. And the present book does suggest an explanation how the world came to take into its heart the principles represented in Dante, which make him and his writings the exponent of the Life of Christendom.

Coming then to the third line of thought he had laid down for himself, Mr. Asher turned to Mr. Kidd's book itself, illustrating what he had to say with a number of quotations. Mr. Kidd, in his chapter on "The close of an Era," shows that at the time at which he writes, there is a conception of a State which he feels belongs to a previous stage of existence, and must be lost in the newer conception which he offers to us towards the close of his book. All previous systems of social civilization have been considered as revolving round this principle—the interests of certain existing individuals, whom we call Society. But the point of view has been altered by a revolution without any parallel in the history of thought. It is not the interests of these existing individuals with which all our present systems of thought and science concern themselves, but the life and the interests of the future, which await the meaning of the evolutionary processes in history. In the scientific formula of the life of any existing type of social order, the interests of these existing individuals possess no meaning, except so far as they are included in, and subordinate to, the interests of a developing system of social order, the overwhelming proportion of whose members are still in the future. This makes us look at all the processes of our civilization entirely in a new light. Our relation to that which we can possess for ourselves and hold against the world, is opposed to the principle of sacrificing ourselves to something else which we shall never possess. We are interested in our possessions ; we sacrifice to a larger life ; and all the way through the book we find this antithesis. It is fair to say that the State exists at present for the protection of property. Mr. Kidd goes on to say that this conception of the State is due to the teaching of the Manchester School. Theirs are the principles which correspond with the era of the ascendancy of the present in the economic activities of the world. But another influence is at work in the world, which enables men to live for that which they will never enjoy, to live for a larger life which shall never be theirs, and it is in the bringing together of these two factors that Mr. Kidd's book deserves to be most closely examined.

In Chapter II. we are shown that the theory of Natural Selection is not sufficient to account for the forms of life. He

shows that the survival of the individual is not explained by looking at the individual alone, but is in order that he may live for some larger issue. The organism is not only struggling with its own past, but being subordinated to the future, which it is anticipating and bringing into view. The interests of the individual and of the present are always overlaid by the interests of the majority, which is always in the future.

Having concluded the first section of his book, dealing with the past view of a self-centred State, Mr. Kidd, in his second section, shows how the principle has been born in the minds of men, whereby men have projected the controlling centre of life beyond the interests of the existing individual. He does not find it in religion, but in the influence of the non-utilitarian conception of what he calls Western Liberalism in English thought in the Seventeenth Century. The principles of the democracy which our civilization is destined to realise, are incompatible with the materialistic conception of history. In another section he shows the dawning and the purification of the sense of the eternal. He tries to show that there have been a body of men living in the world, obeying the ordinary laws necessary for the survival of the race, but keeping within their heart of hearts a sense of the eternal, and of those principles which will, one day, make all men one. We follow the development of the "vision of universal justice" that filled the consciousness of the Jewish people, until it becomes greater than the race itself, till, at last, associated with an ideal of personal self-abnegation which has passed the bounds of the material, it goes forth to subdue the world in which the principle of the ascendancy of the present had reached its culminating expression. How few students of history consider in this light the problem presented by the early Christian heresies? Mr. Kidd sees in those heresies the tendency to make men live in the present, and thinks that that is the reason why persecution of them was so rife,—because they were attempts to close up that profound antithesis which the human mind would not allow to be closed. He shows that as a result of this new ideal came a new value to the individual life, each individual life being declared to have relation to the eternal. He traces a gradual growth since the time of Charlemagne of the principle that spiritual interests are more important than temporal, while he characterises the Reformation as an attempt to point out afresh men's sense of the eternal, when the Papacy had gradually introduced something of the old military despotism of Rome, and was hindering the other ideal. After the Reformation, there arose a new sense of truth as the resultant of two opposing forces.

Towards the end Mr. Kidd seeks to show us that we are in danger at the present moment of an Empire far more serious, far less grand and dignified than the Empire we have left behind. He shows that the principles which govern the distribution of

wealth are being lowered, by the principle of surviving in a world of free struggle to the lowest level of the persons engaged in competition. So he comes to the possibility of shaking off the awful power of this irresponsible struggle for gain. And in rather obscure phrases he hints that it is only those spaces, in which have been cleared round the ideals which involve the sacrifice of the life of the individual for some larger purpose than his own, that we can shake off the tendency to survive in a free struggle for personal gain, and he seems to suggest that it is in a new order of human society, founded on this desire to project beyond personal interest, that we should come to see the future that is beckoning to the world. He closes with a vision of the life which dies upwards into a larger life, and a new interpretation of the principles of sacrifice which have ever lived in the world, not as representing any connection with the past, but as reaching forward into the unborn future.

WEDNESDAY, APRIL 29TH.

Hollingbury Camp.

MR. H. S. TOMS.

HAVING, in a few introductory remarks, recalled to the minds of his hearers that Hollingbury Camp had lately become part and parcel of the municipal property of Brighton, Mr. Toms gave a brief description of the camp. It is situate about 400 yards east of the Ditchling Road, and about a mile N.N.E. of the spot where the Corporation tramway branches into the Drove. It consists of a comparatively shallow ditch with a rampart standing some three or four feet above the level of the surrounding hill crest, and enclosing an area of about six acres. Its shape roughly approximates a square with the corners rounded off, and the sides bulging outwards. There are four entrances, and near the centre of the gorse-covered interior are the remains of pits and a small mound, closely resembling the burial mounds of the Bronze Age. The period to which the camp belongs, Mr. Toms remarked, is still in the realm of conjecture, but all authorities who had grappled with the subject agreed in relegating the camp to an antiquity ranging from the Stone Age to the Roman

occupation of Britain, and in regarding it, together with similar entrenchments capping the South Downs, viz., Cissbury, Chanctonbury, and the Dyke Camp, as having been thrown up for the purposes of fortification. Mr. Toms went on to quote some views expressed by the late General Pitt-Rivers in a paper on the "Hill Forts of Sussex," contributed (under his former name of Col. A. H. Lane Fox), in 1869, to Vol. 42 of the "Archæologia," published by the Society of Antiquaries.

General Pitt-Rivers strongly maintained that these Sussex earthworks, including Hollingbury, are not of Roman but prehistoric origin. He observed that the whole hill-top, or the whole available portion of it, appeared to have been fortified by a line of ramparts drawn along the brow, in the position best suited for defence, and with but little regard to the amount of space enclosed. whereas the Roman practice was to regulate the outline and arrangement of the camps in accordance with the strength of the force intended to occupy them, and with a chief regard to the considerations of discipline, and interior economy. Considerations of the supply of water and fuel were, in these camps, invariably sacrificed to the necessity the people appeared to have been under of occupying the strongest features of the country. He did not meet with a single example in Sussex of a fort having a supply of water within the enclosure, and the majority, like Cissbury, were at a considerable distance from a spring. Nor could fuel have been obtainable anywhere in the immediate vicinity. This, according to Vegetius, was a primary requisite in the selection of a Roman Camp, and among camps of undoubted Roman construction, no instance of a neglect of these principles had been found. The strength of the ramparts in the Sussex forts corresponded inversely to the natural strength of the position. In some places where a steep declivity presented itself, there was no rampart, implying that the defence of those places must have been confined to a stockade. The ditch, generally on the outside, was sometimes in the interior of the work. Outworks were thrown up upon commanding sites, within 200 or 300 yards of the main work. The ramparts at the gateways were increased in height and were sometimes thrown back upon the causeway over the ditch.

This was not a characteristic of a Roman gateway. The occupants of these works frequently dwelt in pits, which was not the Roman practice. These entrenchments were, moreover, in an especial manner associated with evidence of the manufacture of flint implements, found scattered in great abundance upon the surface, whereas the Romans did not use flint for their tools and weapons. Mr. Toms went on to refer to General Pitt-Rivers' subsequent excavations at Cissbury, Hightown, Mount Caburn, and Seaford Cliff, indicating them to be of pre-Roman origin,

after which he compared Hollingbury with Bronze Age camps of Wilts and Dorset in order to disprove the belief that Hollingbury was of Roman origin. Like Hollingbury these Wilts and Dorset camps were thought to be Roman because of their rectangular shape, but the excavations which he (Mr. Toms) had the honour of personally conducting at those camps conclusively proved them to be the work of the Bronze Age. Passing on, Mr. Toms, with the aid of several diagrams, proceeded to show that Hollingbury owed its present aspect to the action of the weather, which caused the sides of the trench and rampart to fall into the trench, the bottom of which would very soon be covered with chalk rubble, and the sides partly so. Then a finer mixture, washed and drifted into the trench, would accumulate, and over all turf would grow, and mould accumulate by vegetable decay, the tendency of all this being ever in the direction of softening and reducing the outlines of the earthwork, and eventually almost their obliteration.

Coming to the question of how to determine the age of a camp, he showed that this could be done by careful excavation and analysis of the deposit with which the trench had become filled during the lapse of ages. Relics in the bottom of the trench or in the body of the rampart would obviously belong to the period of the first construction of the entrenchment, and the objects found would naturally be of more and more recent date in the later and latest deposits. The relics in the trench would, in fact, be found to be arranged, so to speak, in chronological order. Dealing next with the best method of excavation by means of which to determine the age of Hollingbury, he shewed the importance of first preparing a carefully contoured plan, and then pointed out the right and wrong ways of excavating sections of the earthworks. The proper way was to take the turf off first, and then work down layer by layer, removing and recording the depth and position of the pottery, &c., found in the upper layers before digging into the lower layers. If necessary, the whole of the ditch and rampart should be explored in a similar manner, and after the earthworks had been explored, the interior area of the camp should be similarly trenched for traces of occupation. As the evidence bearing upon Hollingbury's age still lay hidden beneath the soil, they could only conjecture the nature of the objects forming the clue ; but from a comparison of the results of excavations made elsewhere, they might safely say that this question would be mainly solved by the shards of broken pottery invariably found in great numbers in earthworks of this kind.

Pottery alone, however, was not a safe criterion by which to determine the age of an earthwork. Other evidence, however slight, of the metallic or non-metallic periods was required to confirm the conclusion to which the pottery pointed. Finishing

his paper with a consideration of the connection which it was supposed that the earthworks of the South Downs had with each other in the defence of the country, Mr. Toms inclined towards the views of General Pitt-Rivers, which were opposed to the hypothesis of older archaeologists that these entrenchments formed part of a triple series of forts. Confirmation of this view they imagined could be found in the position of the gateways of these forts ; but General Pitt-Rivers thought there was nothing in the position of the gateways or works themselves incompatible with the hypothesis of their having been isolated works, erected by several distinct tribes, as a protection against the incursions of their neighbours. The earthworks of the South of England, General Pitt-Rivers believed, led us rather to infer the existence of frequent intestine wars, in which each section of the community fortified itself against its immediate neighbours, than of any extensive and combined system of national defence. Another weak point in the evidence of connection supposed to be afforded by the position of the gateways, which had hitherto been overlooked, was that sometimes a footpath or road lead into, across, and out of the camp, the points of entrance and exit being through a depression in the rampart which looked so uncommonly like one of the old gateways, as to raise a question whether these entrances formed part of the original design of the earth-work. The only way to settle the difficulty was by excavation at these points, but as none of the Sussex forts had been thoroughly and systematically investigated, the question of the original number of entrances and their hypothetical bearing upon the relation of the camps must remain in abeyance until such had been done. Mr. Toms answered several questions, and suggested, amid applause, that steps should be taken to preserve the camp. The hearty vote of thanks to him, moved by Mr. Clarkson Wallis, was carried with acclamation.

WEDNESDAY, MAY 20TH.

Natural Science at Rome at the time of Christ.

F. R. HORA, B.A., B.Sc., &c.

MR. Hora pointed out, first, that in any country, schools of philosophical thought prevalent in any age, are the product mainly of the political and social condition of the people.

Secondly, he gave a picture of the horrible condition of Rome about B.C. 40 as it emerged from its old republican soil to spread abroad as a vast military Empire. Roman Natural Philosophy was mainly built up from the débris of the fast decaying Greek philosophical schools. Hence we see flourishing at Rome three main schools : (1) Academic—modified (one might almost say degraded) from the pure Idealism of Plato to a Sceptical Materialism. (2) Stoic School, which did not concern itself much with Natural Philosophy, its ethical system appealing so strongly to those who cherished the rigid, almost brutal, traditions of Rome's earlier heroes. (3) The Epicurean School—of which we know most at the present time, since a complete exposition of its tenets by one of its most cultured adherents has come down to us, viz., Lucretius' magnificent poem, *De Rerum Naturæ*. With all its glaring absurdities, its contempt for religion and its many contradictions, the outline of its philosophy resembles very much our modern notion of evolution. It was exceedingly popular at Rome and included in its folds such literary men as Virgil, Horace, Ovid and Lucretius. He pointed out how much and yet how little these schools did for modern thought. Want of instruments of precision, of a science of chemistry, of algebraical geometry, and of a systematic experimental study of Nature instead of mere speculation unaccompanied by experiment, account for its slow progress.

Lastly, Mr. Hora pointed out that in a measure the same problems confront us now as they did the Romans at the time of Christ—the nature and origin of the Universe, God, and morality.

WEDNESDAY, JUNE 10TH, 1903.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 10TH, 1903.

It may not perhaps be generally known to the Members that this year the Society is about to enter on the fiftieth year of its existence. The first Meeting of the Society was held on September 1st, 1854. Among those who took an active part in its formation, just half a century since, and whose names appear as Members of the First Committee of Management, are Mr. Barclay Phillips, who now lives at Bedford, and Mr. George de Paris, to whose energy and resource the Town and Corporation of Brighton are so much indebted as Chairman of the Fine Arts Committee.

The First Annual Report is dated September 13th, 1855. This modest unpretending booklet,—somewhat of a curiosity now,—lies on the table for your inspection.

For just on 50 years the Meetings of the Society, appointed to be held in the second week of each month between September and June, have gone on uninterruptedly.

We cannot chronicle the admission of 74 new Members in this Report as in that of 1855, but it is satisfactory to be able to record that there are 170 names on the list, and that the Meetings during the past year have been more than ordinarily well attended.

We have to mourn the loss by death of two old Members who once took an active part in the work of the Society, viz., Mr. Alderman Cox, who joined in 1871, and Mr. Alderman Davey, who became a Member in 1872 and was Hon. Auditor for some years. During the past year we have lost nine Members, three by death and six by resignation, and eleven new Members have been elected.

The re-building of the Public Library has necessitated the purchase of new bookcases for the Society's books. These have been obtained at a cost of £16 10s. 6d. The Council regret the

delay which has occurred in the issue of books to Members, the causes of which are alluded to in the Librarian's Report.

There were six excursions, namely :—

- May 24th. Balcombe.
- June 21st. Ashdown Forest—Wych Cross—Sheffield Park.
- July 5th. St. Leonards Forest—Beacon Hill—Holmbush Tower
—Pease Pottage—High Beeches.
- July 19th. Henfield—Edburton—Woodmancote.
- Sept. 20th. Steyning—Chanctonbury Ring.
- Oct. 4th. Falmer—Newmarket Hill—Lewes.

Papers read at Ordinary Meetings :—

1902.

- Oct. "Progress and its Illusions."—
Mr. E. A. PANKHURST.
- Nov. 5th. "British Oak Trees, and the Galls found upon them."
Mr. E. CONNOLD.
- Dec. 3rd. "Progress and its Illusions, II."—
Mr. E. A. PANKHURST.

1903.

- Jan. 15th. "A Naturalist's Ramble on the Seashore"—
Mr. MARTIN DUNCAN.
 - Feb. 18th. "Travelling in Mid-Air."—Mr. E. STUART BRUCE.
 - Mar. 12th. "Mr. Benjamin Kidd's Principles of Western
Civilisation."—Rev. FELIX ASHER.
 - April 22nd. "Hollingbury Camp."—
Mr. H. S. TOMS.
 - May 13th. "Natural Science at Rome in the time of Christ."—
Mr. F. R. HORA.
-

METEOROLOGY OF BRIGHTON.

TEMPERATURE OF AIR DURING MONTH.		WIND.		RAINFALL.		SUNSHINE.	
Month.	Highest.	Lowest.	Mean.	Number of Days on which Rain fell	Amount collected in Inches.	Number of Sunless Days.	Number of Hours recorded.
July,	1902	60.6	61.7	238.32	220.23	1	238.32
,"	1877-1902	45.0	44.4	182.01	202.83	2	220.23
August,	1902	61.0	62.1	186.08	160.27	1	182.01
,"	1877-1902	44.3	40.0	186.08	160.27	2	202.83
September,	1902	58.9	58.4	111.19	88.11	6	186.08
,"	1877-1902	35.9	33.2	59.25	59.25	6	111.19
October,	1902	62.8	60.0	66.52	66.52	9	88.11
,"	1877-1902	51.3	47.4	50.17	49.10	9	59.25
November,	1902	51.7	47.4	54.98	54.98	14	66.52
,"	1877-1902	29.5	29.8	54.98	54.98	14	50.17
December,	1902	63.5	53.2	59.10	59.10	8	54.98
,"	1877-1902	17.9	17.6	54.98	54.98	4	59.10
January,	1903	21.8	16.3	54.98	54.98	5	54.98
,"	1877-1902	17.6	16.3	54.98	54.98	5	54.98
February,	1903	22.5	17.4	54.98	54.98	8	54.98
,"	1877-1902	12.0	17.4	54.98	54.98	8	54.98
March,	1903	31.9	20.2	54.98	54.98	12	54.98
,"	1877-1902	42.6	31.1	54.98	54.98	12	54.98
April,	1903	51.0	41.6	54.98	54.98	11	54.98
,"	1877-1902	51.0	41.6	54.98	54.98	11	54.98
May,	1903	51.0	41.6	54.98	54.98	11	54.98
,"	1877-1902	51.0	41.6	54.98	54.98	11	54.98
June,	1903	51.0	41.6	54.98	54.98	11	54.98
,"	1877-1902	51.0	41.6	54.98	54.98	11	54.98
Entire Year		80.8	21.3	51.0	51.0	7	68
Average of 1877-1902		80.4	12.0	50.3	50.3	7	64

BRIGHTON AND HOVE NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 10th June, 1903.

Dr.	£ s. d.
To Balance in the hands of the Treasurer, 11th June, 1902 	22 11 9
Annual Subscriptions to 1st October, 1902 	13 0 0
" Annual Subscriptions to 1st October, 1903 	55 10 0
" Entrance Fees 	4 0 0
" Dividends on £100 2 <i>1</i> / ₄ per cent. Consols for one year 	2 15 0
By Books and Periodicals 	22 11 9
By Bookbinding 	13 0 0
" Printing Annual Report and Abstract of Pro- ceedings 	13 15 0
" Printing and Stationery (General) 	6 4 7
" Postage, &c. (General) 	9 5 8
" Subscriptions to Societies 	3 9 7
" Clerk's Salary 	2 2 0
" Commission to Collector 	3 8 0
" Gratuities to Museum and Pavilion Assistants 	2 17 6
" Expenses of Lectures, Meetings and Excursions, Lantern, Hire of Rooms, Tea, Coffee, &c. ...	8 19 5
" Expense of Mr. Eric Bruce's Lecture £12 5s. 6d. Less £3 9s. for Tickets Sold 	8 16 6
" Cost of Making New Book Cases 	16 10 6
" Fire Insurance Premium on Books 	1 1 0
" Balance 	13 16 9
	<hr/> £97 16 9
Balance brought over 	13 16 9
NOTE.—There is a sum of £100 2<i>1</i>/₄ per cent. Consolidated Stock standing in the names of the Hon. Treasurer and Hon. Secretary, and Mr. E. A. PANKHURST, as Trustees for the Society.	

Balance brought over

*NOTE.—There is a sum of £100 2*½* per cent. Consolidated Stock standing in the names of the Hon. Treasurer and Hon. Secretary, and Mr. E. A. PANKHURST, as Trustees for the Society.*

HON. LIBRARIAN'S REPORT.

The rebuilding of the Public Library and Museum necessitated the closing of the Society's Library during the Spring of 1903, as was recorded in last year's Report. The Reference Library was not completed until February, 1903; and most of the Society's cases were brought there, and an extra one was made, the whole eastern wall of the room being given up to them. Other cases are deposited downstairs. It was hoped and believed the new arrangement would be completed, a new catalogue would be in all the Members' hands, and duplicates valued for sale, before this Annual Meeting; but just after the Hon Librarian began the work, his father, the late Alderman Davey, fell ill, and it has not yet been possible to continue the new arrangement and cataloguing. There is, however, nothing to prevent the completion before the next Session of the Society begins; and it is expected that the new position of the cases in the Reference Library, visible to the public, will cause a much more frequent consultation of the volumes than has previously been the case.

H. DAVEY,
Hon. Librarian.

RESOLUTIONS, &c., PASSED AT THE 50th ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

"That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Librarian's Report be received, adopted, and printed for circulation as usual."

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

"J. E. Haselwood, E. J. Petitfour, B.A., F.C.P., F. Merrifield, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., W. J. Treutler, M.D., F.L.S., J. P. Slingsby Roberts, E. McKellar, J.P., Deputy Surgeon General, and W. Clarkson Wallis."

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. J. W. Nias and Mr. A. F. Graves.”

It was proposed by Mr. H. W. CHARRINGTON, seconded by Mr. J. J. KNIGHT, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year:—*President*: E. Alloway Pankhurst; *Ordinary Members of Council*: Walter Harrison, D.M.D., W. W. Mitchell, F. Hora, B.Sc., G. Morgan, L.R.C.P., F.R.C.S. (E.), E. Payne, M.A., J. Sussex Hall; *Honorary Treasurer*: E. A. T. Breed; *Honorary Librarian*: H. Davey, Jun.; *Honorary Curators*: H. S. Toms and T. Hilton; *Honorary Secretary*: J. Colbatch Clark, 9, Marlborough Place; *Assistant Honorary Secretary*: H. Cane.”

It was proposed by Mr. WALLIS, seconded by Mr. J. P. SLINGSBY ROBERTS, and resolved—

“That the best thanks of the Society be given to Mr. E. A. Pankhurst for his attention to the interests of the Society as its President during the past two years.”

It was proposed by Mr. F. R. HORA, seconded by Mr G. G. BAILY, and resolved—

“That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curator, the Honorary Auditors, and the Honorary Secretaries, for their services during the past year.”

SOCIETIES ASSOCIATED.

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society.

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society, The Museum, College Square, N. Belfast.

Boston Society of Natural Science (Mass., U.S.A.).

- British Museum, General Library, Cromwell Road, London, S.W.**
British and American Archaeological Society, Rome.
- Cardiff Naturalists' Society, Frederick Street, Cardiff.**
City of London Natural History Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History Society.
Croydon Microscopical and Natural History Club, Public Hall, Croydon.
City of London College of Science Society, White Street, Moorfields, E.C., & "Hatfield," Tenham Avenue, Streatham Hill, S.W.
- Department of the Interior, Washington, U.S.A.**
- Eastbourne Natural History Society.**
- Edinburgh Geological Society.**
- Epping Forest and County of Essex Naturalist Field Club, West Ham Institute.**
- Folkestone Natural History Society.**
- Geologists' Association.**
- Geological Society of Mexico.**
- Glasgow Natural History Society and Society of Field Naturalists.**
- Hampshire Field Club.**
- Huddersfield Naturalist Society.**
- Leeds Naturalist Club.**
- Lewes and East Sussex Natural History Society.**
- Maidstone and Mid-Kent Natural History Society.**
- Mexican Geological Institute, 2, Calle de Paso Nuevo, Mexico.**
- North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells Bladen, Secretary).**
- Nottingham Naturalists' Society, Hazlemont, The Boulevard, Nottingham.**
- Peabody Academy of Science, Salem, Mass., U.S.A.**
- Quekett Microscopical Club.**
- Royal Microscopical Society.**
- Royal Society.**
- Smithsonian Institute, Washington, U.S.A.**
- South-Eastern Union of Scientific Societies.**
- South London Microscopical and Natural History Club.**
- Southport Society of Natural Science, Rockley House, Southport.**
- Société Belge de Microscopie, Bruxelles.**
- Tunbridge Wells Natural History and Antiquarian Society.**
- Watford Natural History Society.**
- Yorkshire Philosophical Society.**

LIST OF MEMBERS
OF THE
Brighton and Hove Natural History and
Philosophical Society,
1903.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton.

ORDINARY MEMBERS.

- ABBEY, HENRY, Fair Lee Villa, Kemp Town.
- ASHER, Rev. F., 15, Buckingham Place.
- ASHTON, C. S., 10, Powis Grove.
- ATTREE, G. F., 8, Hanover Crescent.
- BADCOCK, LEWIS C., M.D., M.R.C.S., 10, Buckingham Place
- BEVAN, BERTRAND.
- BILLING, T., 86, King's Road.
- BOOTH, E., 53, Old Steine.
- BREED, E. A. 'G., 17, Buckingham Place.
- BROWN, J. H., 6, Cambridge Road, Hove.
- BROWN, GEORGE, Cottesmore, The Upper Drive.
- BULL, W. 75, St. Aubyns, Hove.
- BURROWS, W., S., B.A., M.R.C.S., 62, Old Steine.
- BURCHELL, E., L.R.C.P., 5, Waterloo Place.
- BAILY, G. G., 86, Buckingham Road.
- CARTER, F. W., 130, Church Road, Hove.
- CANE, H., 173, Ditchling Road.
- CATT, REGINALD J., 31, Hampton Place.
- CAUSH, D. E., L.D.S., 63, Grand Parade.
- CHARRINGTON, H. W., 23, Park Crescent.

CLARK, J. COLBATCH, 9, Marlborough Place.
COLMAN, Alderman J., J.P., Wick Hall, Furze Hill.

DAVEY, HENRY, jun., Victoria Road.
DENMAN, S., 26, Queen's Road.
DODD, A. H., M.R.C.S., I.R.C.P., 49, Church Road, Hove.
DRAPER, Dr., Municipal School of Technology.
DUSART, G. C., 13, Chatsworth Road.

EDMONDS, H., B.Sc., Municipal School of Technology.
EWART, Sir J., M.D., F.R.C.P., M.R.C.S., F.Z.S., Bewcastle,
Dyke Road.

FLETCHER, W. H. B., J.P., Bersted Lodge, Bognor.

GILKES, J. H., 6, Hanover Crescent.
GRAVES, A. F., 9A, North Street Quadrant.
GRIFFITH, A., 59, Montpelier Road.
GROVE, E., Norlington, Preston.
GRINSTED, J., 13, Powis Square.

HALL, J. SUSSEX, Ship Street.
HACK, D., Fircroft, Withdean.
HARRISON, W., D.M.D., 6, Brunswick Place, Hove.
HASELWOOD, J. E., 3, Richmond Terrace.
HAYNES, J. I., 24, Park Crescent.
HENRIQUES, A. G., F.G.S., J.P., 9, Adelaide Crescent, Hove.
HICKLEY, G., 92, Springfield Road.

HILTON, T., 16, Kensington Place.
HOBBS, J., 62, North Street.
HOBHOUSE, E., M.D., 36, Brunswick Place, Hove.
HOLDER, J. J., 8, Lorne Villas.
HOWLETT, J. W., 4, Brunswick Place, Hove.
HORA, F. R., 32, Norton Road, Hove.

INFIELD, H. J., Sylvan Lodge, Upper Lewes Road.

JACOMB, Wykeham, 72, Dyke Road.
JENNER, J. H. A., Lewes.
JENNINGS, A. O., LL.B., 11, Adelaide Crescent, Hove.
JOHNSTON, J., 12, Bond Street.

KNIGHT, J. J., 33, Duke Street.

LANGTON, H., M.R.C.S., 11, Marlborough Place.
LAW, J., Crosthwaite, Lewes.
LEWIS, J., C.E., F.S.A., Fairholme, Maresfield.
LOADER, KENNETH, 5, Richmond Terrace.
LONSDALE, L., 13, Powis Square.

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Preston.**

MAGUIRE, E.C., M.D., 9, Old Steine.

MAY, F. J. C., 25, Compton Avenue.

MERRIFIELD, F., 24, Vernon Terrace.

MILLS, J., 24, North Road.

MITCHELL, W. W., 66, Preston Road.

MORGAN, G., L.R.C.P., M.R.C.S., 6, Pavilion Parade.

MUSTON, S. H., 54, Western Road.

MANSFIELD, H., 11, Grand Avenue, Hove.

MATHEWS, H. J., 43, Brunswick Road.

MINTO, J., Public Library.

NEWMARCH, Major-General, 6, Norfolk Terrace.

NEWSHOLME, A., M.D., M.R.C.P., 11, Gloucester Place.

NIAS, J. W., 81, Freshfield Road.

NICHOLSON, W. E., F.E.S., Lewes.

NORMAN, S. H., Burgess Hill.

NORRIS, E. L., 8, Cambridge Road, Hove.

**OKE, ALFRED W., B.A., LL.M., F.G.S., F.L.S., F.Z.S., 32,
Denmark Villas, Hove.**

PANKHURST, E. A., 3, Clifton Road.

PARIS, G. DE, 14, Norfolk Road.

PAYNE, W. H., 6, Springfield Road.

PAYNE, E., Hatchlands, Cuckfield.

PENNEY, S. R., Larkbarrow, Dyke Road Drive.

PETITFOURT, E. J., B.A., F.C.P., 16, Chesham Street.

PUGH, Rev. C., 13, Eaton Place.

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ROBERTS, J. P. SLINGSBY, 3, Powis Villas.

ROBINSON, E., Saddlescombe.

ROSE, T., Clarence Hotel, North Street.

ROSS, D. M., M.B., M.R.C.S., 9, Pavilion Parade.

RYLE, R. J., M.D., 15, German Place.

SALMON, E. F., 30, Western Road, Hove.

SAVAGE, W. W., 109, St James's Street.

SLOMAN, F., 18, Montpelier Road.

SCOTT, E. IRWIN, M.D., 69, Church Road, Hove.

SMITH, C., 47, Old Steine.

SMITH, T., 1, Powis Villas.

SMITH, W., 6, Powis Grove.

SMITH, W. J., J.P., 42 and 43, North Street.

SMITH, W. H., 191, Eastern Road.

STONER, HAROLD, L.D.S., M.R.C.S., L.R.C.P., 18, Regency Square.

SMITHERS, E. A., Furze Hill.

TALBOT, HUGO, 79, Montpelier Road.

THOMAS, J., Kingston-on-Sea.

TREUTLER, W. J., M.D., F.L.S., 8, Goldstone Villas, Hove.

TOMS, H. S., The Museum.

TUOHY, Dr., 1, Hova Terrace, Hove.

WALLIS, E. A., Sunnyside, Upper Lewes Road.

WALLIS, W. CLARKSON, 15, Market Street.

WALTER, J., 13A, Dyke Road.

WELLS, I., 4, North Street.

WHYTOCK, E., 36, Western Road.

WIGHTMAN, G. J., Ailsa Craig, The Wallands, Lewes.

WILKINSON, T., 170, North Street.

WILLETT, H., F.G.S., Arnold House, Montpelier Terrace.

WILLIAMS, A. S., 17, Middle Street.

WILLIAMS, H. M., LL B., 17, Middle Street.

WOOD, J., 21, Old Steine.

WOODRUFF, G. B., 24, Second Avenue, Hove.

LADY MEMBERS.

BAGLEY, Miss, 38, Medina Villas, Hove.

BAKER, Miss EDITH, Highclere, Brunswick Place, Hove.

CAMERON, Miss E., 25, Victoria Street.

CAUSH, Mrs., 63, Grand Parade.

CRAFER, Mrs. M. H., 102, Beaconsfield Villas.

CRANE, Miss AGNES, 11, Wellington Road.

COLLETT, Miss C. H., 8, Marlborough Place.

FARGUS, Mrs., 7, Park Crescent.

HARE, Miss, 19, Goldsmid Road.

HERRING, Miss, 38, Medina Villas, Hove.

HERNAMAN, Miss I., 117, Ditchling Road.

HERNAMAN, Miss V., 117, Ditchling Road.

HOLT, Miss, Diocesan Training College, Ditchling Road.

LANGTON, Miss, 38, Stanford Road.

NICHOLSON, Mrs., 9, Park Crescent.

RICH, Miss, Iken House, Roedean School.

RUGE, Miss, 7, Park Crescent.

STONER, Mrs. H., 18, Regency Square.

THOMAS, Miss MARY, 119, Freshfield Road.

WALLIS, Mrs., Sunnyside, Upper Lewes Road.

WILKINSON, Mrs., 30, Brunswick Place, Hove.

WOOD, Mrs. J., 21, Old Steine.

HONORARY MEMBERS.

ARNOLD, Rev. F. H., The Hermitage, Emsworth.

BLOOMFIELD, Rev. E. N., Guestling Rectory, Hastings.

CURTEIS, T., 244, High Holborn, London.

DAWSON, C., F.G.S., Uckfield.

FARR, E. H., Uckfield.

HOLLIS, W. AINSLIE, Palmeira Avenue, Hove.

MITTEN, W., Hurstpierpoint.

NOURSE, W. E. C., Norfolk Lodge, Thurlow Road, Torquay.

PHILLIPS, BARCLAY, 7, Harpur Place, Bedford.

LOMAX, BENJAMIN, The Museum, Brighton.





BRIGHTON & HOVE
Natural History and Philosophical
Society.

Abstracts of Papers

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 8th, 1904.

Brighton:

"BRIGHTON HERALD" Printing Works, Prince's Place.

1905.

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HARVARD COLLEGE LIBRARY
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JUN 10 1942

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OFFICERS OF THE SOCIETY, 1903-4.

President :

HENRY DAVEY.

Past Presidents :

W. E. C. NOURSE.	GEORGE DE PARIS.
F. MERRIFIELD, F.E.S.	D. E. CAUSH, L.D.S.
A. H. COX, Ald., J.P.	A. NEWSHOLME, F.R.C.P.,
L. C. BADCOCK, M.D.	M.O.H.
W. AINSLIE HOLLIS, M.D., F.R.C.P.	E. J. PETITFOURT, B.A., F.C.P.
J. EWART, Kt., M.D., J.P.	J. P. SLINGSBY ROBERTS.
J. E. HASSELWOOD.	W. J. TREUTLER, M.D.
W. SEYMOUR BURROWS, M.R.C.S.	W. CLARKSON WALLIS.
	E. ALLOWAY PANKHURST.

THE COUNCIL.

The President.

Vice-Presidents :

(Rule 25.)

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SESSION 1903-4.

THURSDAY, OCTOBER 15TH, 1903,

The Relationship between Poetry and Science.

BY

THE REV. FELIX ASHER

(Vicar of Holy Trinity, Ship Street, Brighton).

SCIENCE is apparently truer and more permanent than poetry, for it deals with facts as they are ; the poet allows the facts to be transformed by a medium of feeling. Science again appears to see the present actual world, while poetry lives, often, by contemplating the beauty of an ever-receding past. Yet, if we turn to concrete poems like Tennyson's "Break, Break, Break," we find our assumption hardly holds good. The poem written between 1830-1840 is much fresher to-day than the science of that period. A stanza of Gray's Elegy touches our emotions now, but who would learn of the science of the 18th century ? The greatest poet of all—Shakespeare—lived when science was hardly born and his voice is as clear as ever, while we ignore the scientific glimmerings of his day. All this goes to show that poetry, once created, lives on unchanged, while a phase of scientific thought, however accurate, lasts but a short time and is merged in the complete synthesis which follows it.

Again, the poet "sees into the life of things." He is not content, like the scientist, to abstract certain features of living or dead phenomena, and formulate the connexions between such abstractions ; the poet penetrates to the essential nature, the deep mysterious throb of life which animates each separate thing and the whole universe in which it finds itself. The scientist describes things and maps the world out for us ; the poet explains their being and their end and gives us, in song, the joy which he feels at his discovery. The scientist brings his message of the external

forms of things, the marvellous features of the world in which we live ; he purges our minds of harmful illusions and checks unwholesome sentiment. The poet, on the other hand, brings us musically and with emotion his discovery of the expression of the face of the world. To him the world and every fact in it, is translucent and looks beyond itself.

We need the message and the help of both poet and scientist for restraint and inspiration.

WEDNESDAY, NOVEMBER 4TH, 1903.

Fossil Hunting in the Libyan Desert.

BY

DR. CHARLES W. ANDREWS, F.G.S.,

Of the British Museum.

THE Lecture was mainly descriptive of the topography and geology of the Libyan desert which lies to the west of Egypt. It is but sparsely inhabited, subject to violent alternations of heat and cold, and often swept by suffocating sand storms, whilst rain is almost unknown. This vast wilderness, by its natural dryness and inaccessibility, proved peculiarly suitable for the preservation of the fossil remains of those strange mammals who were the denizens of the place during the upper Eocene, Oligocene and Miocene epochs.

Dr. Andrews conducted most of his researches in the bed of a mighty river which seems like the ancestor of the Nile as we know it now. Many lantern slides were shown illustrating the remarkable diversity of its surface, the fantastic escarpments, the strange isolated bluffs cropping up from level plains like the monuments of a Titanic race rather than the work of natural agencies. The famous Sphinx, by the way, was shown to be one of these natural monuments, carved into shape afterwards by human agencies. A rich harvest of fossil forms, some absolutely unique and unlike any animals now existing or extinct forms hitherto discovered, was the Lecturer's reward for many months' life (under by no means congenial conditions) in this lonely and vast desert. Some of these fossils formed links in the evolution

of the elephant's tusks and trunk which, as the Lecturer remarked, was not quite in the same way as that described in Rudyard Kipling's "Just So" stories. One find was that of an absolutely new animal, probably related to the elephant, but which no one yet had been able to classify with certainty. A picture of the skull was shown—quite as fantastic as that of the New World Tinoceras, referred to in a later lecture by Dr. Smith Woodward. Reference was also made to the discovery of the remains of a huge snake, probably a water snake, comparable in size to the so-called Sea Serpent.

Great amusement was caused by the Lecturer's caustic comments on the "Superciliousness" of the camel who seemed fully to realize that he was indispensable to a dweller in the wilderness, and gave himself airs accordingly, as well as the thievish ways of the Arab attendants who accompanied him.

THURSDAY DECEMBER 3RD, 1903.

Structure and Form of Shells.

BY

MR. EDWARD CONNOLD, F.E.S.

(Hon. Sec. of the Hastings and St. Leonards Natural History Society),

WITH LANTERN ILLUSTRATIONS.

THE common garden snail and the common whelk were types of creatures, which were known to naturalists as molluscs. All molluscs began their existence in the egg form, and there was a great variety in the shape and size of the eggs. There was also a great difference in the manner in which they were deposited by the parent. Some little snails were hatched within the mother, and born alive, but the majority came forth from the eggs after they had been laid. Some molluscs laid their eggs singly, or in masses, others produced them in the form of a ribbon, and were either left free or were attached to some object. There was also a considerable diversity in their size, which ranged from a small speck to the size of a common snail shell. When

they emerged from the egg they were known as the larvæ, and if they had not a shell at the time of birth, they soon began to form one. In this condition they could swim about in water, and on their back they formed the shell, while the ventral surface became the foot or creeping disc. But changes soon and rapidly took place, and the visceral sac and the shell became coiled in a nautiloid form, and at this stage it depended in the case of univalve shells as to which form the shell would assume, whether a dextral or right hand, or sinistral or left hand.

The visceral sac was covered with an integument known as the mantle, the epidermis of which was filled with secretive glands, and these produced the materials for the formation of the shell.

The formation and deposition of the shelly material was then shown on the screen, as also were microscopic fragments of the materials by some five or six slides.

The shell consisted of three distinct layers ; the inner layer having a nacreous or mother of pearl texture. Next to that was the portion known as the porcellanous or prismatic layer. It was composed of large pallisade-like prisms which were placed side by side. The texture was something like the enamel of teeth. It contained the colouring pigments which gave to most shells the charm they possessed to almost everybody. The outer surface of the shell was covered with a horny cuticle, known as the epidermis or periostracum. Both it and the prismatic layer were secreted by the free edge of the mantle. It was composed mainly of chitinous substance and served as a protection to the external surface of the shell, and in many instances acted as a varnish by throwing into relief the colouring beneath. The mantle, in the case of bivalve shells, was developed on two sides of the animal into a right and a left lobe. In the univalve shells it was continuous. The skin of the mantle consisted of three parts : a one layered epidermis of columnar cells, a highly vascular connective tissue containing abundant muscular fibres, and the ciliated layer of cells.

The shell was composed of carbonate of lime and conchyolin. As a rule it was hard and calcareous, but some were delicate in structure, horny, and flexible. The periostracum varied greatly in its different qualities. (A slide was shown in which it was seen on shells, as long course fibres growing, as it were, out of the shells, while other specimens showed it produced to a great length beyond the end of the valves and forming a strong leathery casing for the siphonal tubes of the mollusc).

In some shells it was closely adherent and even connected to the valve, while in its coarser forms it would peel off after the death of the mollusc.

The lecturer pointed out that it must not be confused with the epiphragm which was a kind of lid or covering made by many kinds of snails to the opening of the shell ; nor yet with the operculum, which was a horny formation in some, and of a shelly

nature in other kind of shells, the latter being a movable apparatus for partially or wholly closing the aperture, and fully under the control of the animal inhabiting the shell. A unique arrangement found in the shell of a small land snail consisted of a movable door fixed by a tiny hinge fastened to the interior of the shell. In shape it was somewhat like the bowl of a spoon. The name given to it was the clausilium, and from that the family of those shells was called *Clausilia*. (A further illustration of peculiar formations of the interior of some shells was shown in specimens of rock borers dug out of the rocks and wood of the submerged forest at Bulverhythe). This particular formation was shaped like a sickle, and it served as a point to which the foot and viscera of the animal were attached. No other shells than those of the *Pholas* family had this object.

Very few bivalve shells were without teeth. These teeth varied considerably in number. Some shells had but one or two, while one shown on the screen was stated to have nearly 270. A photo-micrograph of several of these teeth assisted the explanation of their form and use. A tough leather-like arrangement for holding the valves together and retaining them so that they can open and close with ease and exactitude; and the peculiar yet perfect arrangement of the muscles controlling the action of the valves as well as the movements of the animal within were then illustrated by written description thrown upon the screen in white letters. Having further dealt with several features of the internal economy of shells in general, the lecturer passed on to describe the external topography, pointing out the margins, the umbones, the spines, the ribs and ridges, the lines of growth, and the general plan of ornamentation of the shell, each and all of the features being illustrated by photographs of shells from the lecturer's cabinet of specimens in the Hastings Museum.

But it appeared that some molluscs had a shell formed within the body, the common Squid has a horny substance in the form of a gladius or pen; the Cuttle had, what was familiar to many people in the form of the well-known cuttle bone. (Of this object several interesting photo-micrographs showed the remarkable construction of different portions.)

The common garden slugs also had either a small internal shelly plate or granules of calcareous substance, the formation of which was shown as seen under the microscope.

At the present day about 25,000 different kinds of shells were known, and among them there was an enormous variety in size and shape as well as colouring. The *Nautilus* shell was shown as a type of one form; the common whelk as another, and the scorpion shell as another. The beautiful cowries, beautiful in colouring and form, served as illustrations of the remarkable difference in the appearance of the shell of a young cowrie and that of the fully-grown or adult animal. The *Haliotis* or ear shell

was shown to possess, in addition to its peculiar shape, a wealth of prismatic colouring of great delicacy. Shells consisting of eight pieces were given as examples of a family which live like limpets attached to rocks on the English coasts, some being found at Bulverhythe. They rejoiced in the name of sea-woodlice, and, like those creatures, could roll themselves into a ball. The shells of the rock borers were white, adorned with prickly sculpture, and although thin, were strong. The valves of all the species did not meet, and when such was the case the spaces were filled in with other portions termed accessory plates. The animals forming these shells emitted a phosphorescent light. This was shown in some living specimens which the lecturer had procured from the rocks for the occasion. The opening and closing of oyster valves was also demonstrated with specimens. In a concluding view a cluster of beautiful barnacles was shown. These, it was stated, did not belong to shells proper, because the structure of the barnacle was widely different from that of a mollusc, nevertheless most people spoke of them as shell fish. The illustration was from a photograph taken by the lecturer's father some years ago when a log of wood about 30ft. long was washed ashore at St. Leonards, and was almost covered with living barnacles.

WEDNESDAY, JANUARY 20TH, 1904.

Memory and Its Diseases.

BY

MR. A. M. SYDNEY-TURNER,
M.R.C.S., F.Z.S.

COMMENCING with a classification of the degrees of memory, the Lecturer enumerated four. First there was the conscious but unorganised degree, which was evanescent, and was illustrated in the greater number of incidents which pass under our daily observation, and which in many cases disappear for ever from the memory. Next came the conscious and semi-organised degree, shown in the grasping of a language or manual art which is being learnt, but in which the student is not proficient. The third degree was less conscious and nearly organised, the memory of the mother tongue being the case in point here. The fourth was

almost unconscious and completely organised—a degree typified by the memory of the expert musician, the skilled artizan, accountant, or surgical operator. Dr. Sydney-Turner went on to point out how the views of Scotch and other psychologists are limited to a certain phase of memory. He emphasized the contention that memory can exist without localisation in time, this representing only the extent of consciousness in the act of memory and nothing more. He defined the anatomical mechanism of memory as the production of certain associations of impressions made upon the nerve cells. He found it necessary to add one more classification to the degrees of memory—consisting solely of reflex impressions which are fixed by long experience during the evolution of species. This he described as the bridge between individual and hereditary memory. They must remember that the impressions they received were not impressed on an inert substance, as in the case of a stamp on a pat of butter or a die on metal. They were recorded in living matter, and it was only reasonable to suppose that as nutrition supplied new material, so this new material occupied the same place and had the same functions as the old. So that memory directly depended on nutrition. Turning to a novel theory, he asked was it going too far to say that there might be an atomic memory—that each portion of germplasm carried in itself a memory capable of entering into well-defined associations with any other portion when opportunity was given?

Coming to mental disease, the Lecturer said its onset was indicated not by intellectual disorder, but by changes in the character of the individual. An attack was rarely so sudden but that there had been some preliminary indication, often so slight as not to be recognised. Dealing with the many phases of mental disease, he said temporary amnesia generally made its appearance suddenly and ended abruptly. It embraced periods of time which might vary from a few minutes to several years. Epilepsy in its various forms gave the best examples of this ; and a dream gave a good illustration of the mental state of epileptics. Dreams of which all remembrance vanished on waking were very common ; others persisted in our waking moments, but were soon lost. All of them had at some time tried vainly to recall a dream—pleasant or otherwise—of which only an impression remained. The explanation was that the states of consciousness which form the dream were extremely weak. They seemed to be strong at the time, and were so, not of their own strength, but because no stronger state existed to force them into a secondary position. At the moment of waking the conditions changed, and images disappeared before perceptions, perceptions before a state of sustained attention, and this last before a fixed idea or full external consciousness. Periodic amnesia was more remarkable for the information it gave as to the existence of an

ego or conscious personality, than for its effect on the mechanism of memory. These cases showed that personality or ego did not depend entirely on memory ; but it was so difficult to define personality that one could only conceive it as a bodily condition, or organic consciousness, that being constantly renewed, was nothing more than a habit. Another variety of periodic amnesia comprised somnambulism. Usually sleepwalkers after an attack had no recollection of what they had done in it, but in each crisis they recollect what took place in previous crises.

Progressive amnesia was a condition of memory in which the impairment was slow, but continuous, resulting in the complete destruction of the memory. The development of the disease was so gradual as to conceal its gravity. It was a common symptom of general paralysis, and lunatic asylums were full of patients of this class, who, on the day after entry, insisted that they had been there for a year, or many years. Recollection, however, of what was done and acquired before the onset of the disease, was retained with great tenacity. Partial amnesia furnished them with almost miraculous cases, and were they not authenticated beyond doubt one would hesitate to believe in them. That a person should be deprived of his recollection of certain words and retain the rest of his memory intact ; that he should forget entirely one language and remember others ; that there should be a loss of memory for music and nothing else, seemed hard to imagine. But if they remembered that they were accustomed to apply the word memory to an independent function, a faculty, or a personified abstraction, whereas it was really a compound expression, and that it might be resolved into memories, they would understand the seeming impossibilities. Aphasia and hyperamnesia were other forms of memory disease. Giving instances of varying forms of this latter, he said there were few of them who had not at some time had the impression that some state they found themselves in, or some object they were seeing presumably for the first time, had been experienced or seen on a prior occasion. He took it that these were awakenings of the memory due to a prior impression forgotten by ourselves until now excited by some external cause similar to the one which first impressed it. Again, there were many accounts of drowning persons saved from imminent death who agreed that at the moment of asphyxiation they seemed to see their whole lives unrolled before them in minute detail. These cases showed a hyperintensity of action on the part of the memory of which they could have no idea in the normal state. These cases would also seem to indicate that nothing is really lost in memory, however fleeting and trivial the primitive acquisition might have been, but that all were not preserved to the conscious memory except under the impulse of some supreme emotion such as would be experienced when in imminent danger of death.

WEDNESDAY, FEBRUARY 10TH, 1904.

The Smaller Denizens of our Ponds, Lakes, and Rivers.

BY

MR. F. MARTIN-DUNCAN, F.E.S., F.L.S.

MR. MARTIN-DUNCAN at the outset of the lecture observed that the gentle art of pond hunting had its attendant risks. On one occasion he himself when fishing for a small piece of weed, was suddenly and unexpectedly pushed into the pond by a billy goat, and came out of it (to quote his own words) "Like unto a river god." The amount of time and patience requisite for photographing successfully the appearance and habits of small organism was exemplified (1) in the preparation of lantern slides showing "Cell conjugation and fusion in Chara" which entailed six hours close watching ; (2) in photographing a Rotifer, which remained three hours in its glassy like castle before it would show itself. The results as displayed by the lantern were much appreciated.

Specimens were then shown of desmids, infusoria and hydras, and the curious "somersault" method of locomotion adopted by the latter explained. Passing to the Rotifers, Mr. Martin-Duncan showed a highly magnified specimen whose constituent cells presented the appearance of a pyramid of tiny bricks, and delicate tints of different colours, he explained, could be conveyed to the cells by merely colouring the creature's food. Other Rotifers with their coronæ expanded, some like snowy plumes of delicate texture, and others like peacock's tails set in trellis work, were shown, and an explanation was given of the use of the corona in securing water fleas, etc., which made up the animal's food. On the subject of water fleas the lecturer explained how certain carnivorous plants living in ponds lured them into their bladder like body which is provided with a door opening from the outside only ; this successfully imprisons the too curious water flea who soon perishes and is digested by the juices secreted by the plant.

Excellent slides were shown illustrating the life changes of the dragon fly. Always a voracious feeder, the larva has a heavy

under-lip provided with a formidable pair of jaws, carefully concealed when not in use, whilst the adult when flying about, seems to kill butterflies, etc., merely for the sake of killing.

Male and female water beetles, the larvæ of gnats and mosquitoes were also shown, and with the last the lecturer drew attention to the breathing apparatus which necessitated their rising to the surface of the water, hence medical men strongly advocated pouring paraffin oil on stagnant pools in districts infected with malaria or yellow fever, since the poison giving rise to these terrible diseases is now known to be conveyed entirely by certain species of mosquitoes, and the layer of paraffin would prevent the larvæ protruding their breathing apparatus above the water, and so they would perish.

Attention was then directed to the water spider and his ingenious diving bell. First a globe of water-proof silk is spun at the bottom of the pond, and then, by periodic visits to the surface of the water, small air bubbles are collected around the spider's body and introduced into the silk bell so as to make it habitable.

Finally, a slide was shown and a description given of the stickleback's little nest. The female is with difficulty enticed into the nest, and having laid her batch of eggs, she secretly departs and leaves the work of tending the nest to her hardworking, dutiful lord, who certainly does his work well. One nest the lecturer kept for some time was constantly attacked by caddis worms, and, despite the sentry-like and fighting qualities shown by the male stickleback, it got destroyed and the undeveloped eggs rolled out and were devoured by the other sticklebacks in the tank, including the fickle mother.

WEDNESDAY, MARCH 9TH, 1904.

The Evolution of the Horse.

BY

DR. A. SMITH-WOODWARD, LL.D., F.R.S.

(Keeper of the Department of Geology, British Museum.)

DR. SMITH-WOODWARD commenced by saying that the horse was a very satisfactory animal to deal with as regards tracing its evolution. In the early part of the Tertiary epoch, the ancestor, *Phenacodus*, was an animal about the size of a small collie dog, living mostly in water and in marshy districts, each of its feet five toed, widely spread to enable it to walk on soft ground, with a long tail to help it in swimming. The different stages were shown whereby the neck in the early animal, devoid of lateral movements, evolved into the flexible sinuous neck of the modern horse, capable of being turned quickly in every direction for self protection. The teeth, originally adapted for chewing succulent vegetable food only, had developed in course of time into the powerful grinders which the horse now possesses. The limbs, in early times able to execute a turning movement like the human arm, had settled down into ones adapted only for forward and backward movement, and were exquisitely contrived for rapid locomotion. With close detail and many diagrams, the Lecturer showed how the original five toes of the foot, adapted for soft ground, dwindled to three, and how the exterior toes of the three by disuse became less and less important and smaller in size, until they had shrunk into mere vestiges, leaving the central toe expanded and hardened into the hoof, so excellently adapted for galloping over hard ground. With regard to cloven-footed animals, two toes out of the five survived. No better example of adaptation of animals to changed conditions of life could be produced.

Incidentally allusion was made to some of the monstrous ungainly forms that developed from the same ancestor *Phenacodus*, and pictures were cast on the screen of the probable appearance of the *Tinoceras*, *Titanotherium*, &c. Referring to the fantastic horns that adorned *Tinoceras*, Dr. Smith-Woodward

said that it was characteristic of certain animal families that when they grew anything in the nature of bony horns they came to an end ; horns were eccentricities which did not persist. As in modern times, so in the long history of evolution, it was mediocrity that governed the world ; mediocre animals of a species formed the basis of the next advance.

Attention was next drawn to the tapir (a skeleton of which was shown), an animal found nowadays only in South America and the Malay Peninsula ; in former times tapirs existed all over the world and were survivors of one of the stages through which the primæval quadruped went in the course of its development into the horse.

The hipparion was also briefly alluded to ; in appearance not unlike our pony, it was extensively spread all over the world. In Spain there were miles of beds composed of its bones, and numerous whole skeletons of it had been dug up in Greece. Hipparions must have roamed over prehistoric Europe, Asia, and North America in countless numbers. In South America, which was isolated from the rest of the world during part of the Tertiary Epoch, whilst North America, Asia, and Europe were all connected, animals were found shaped like the horse which had been evolved quite independently from different animals. The most reasonable explanation was that such changes are mainly produced by environment, so that like outside conditions produce like results, so far as animal structure was concerned.

In answer to a question from Mr. Pankhurst, the President, as to how these varying forms of animals came to be exterminated, Dr. Woodward said the question was a difficult one to solve. In South America whole herds of animals at the present day were killed by a dry season or an extreme winter, and the probability was that there were coincidences of unfavourable conditions over a considerable area, which caused the destruction of these now extinct animals. It had been noticed how in times of distress animals would congregate into one spot to die, and the piles of bones massed in particular places hinted that this had happened in long forgotten ages, long before man came on earth. Obnoxious insects had also a good deal to do with killing off animals in the regions they infested.

THURSDAY, APRIL 21ST, 1904.

The Birds of Brighton and Neighbourhood.

BY

MR. E. ROBINSON.

AT the outset, Mr. Robinson remarked that the neighbourhood of Brighton, despite the enormous number of telegraph and telephone wires which always proved a fruitful source of destruction to bird life, was really a good place to pursue the study of ornithology. The town possessed an unique Bird Museum, bequeathed to it by the late Mr. E. T. Booth, and several rare species had been either seen or captured both in the precincts of the town and in the neighbouring districts; e.g., spoonbills, storks, little bitterns, White's thrush, woodcocks, landrails, &c. He then drew attention to the difficult question of the "Phases of colouration" in birds. In most feathered fowls the change is effected by a complete moult; with the bunting family and some of the finches, a light edging grows on the plumes which hides the brighter colours beneath its fringe; as spring approaches the tips are gradually shed so that the underlying tints are revealed.

Mr. J. G. Millais in a paper in the *Ibis* of 1896 showed that as regards some birds, e.g., "Sclavonian Grebe," as the old feathers gradually "blush" the new ones assimilate themselves during their growth to the changing old ones. Again, among the waders is the "Sanderling"—a bird which adopts a complete recolouration of the feathers in new form, only a few being moulted and replaced by the summer ones—the change is wrought not by the grey edges of the feathers wearing off but by the colouring matter moving down and obliterating the white; after this the edge wears off, causing its form to be completely altered. These changes the Lecturer illustrated by carefully drawn diagrams.

The Lecturer then considered the much discussed question of "Migration," most of our present knowledge of which we owe to the labours of the Migration Committee of the British

Association. The supposed southward movement during winter of most of our common birds is doubtless much exaggerated. Many careful investigators, including the lecturer, have watched minutely individual birds of various species possessing some distinguishing mark daily throughout the winter, and found they have clung closely to the locality during the whole time.

Mr. Robinson then gave a short account of Mr. Eagle Clarke's researches on Migration which extended over a period of 31 days at the Kentish Knock lightship (stationed 21 miles N.E. of Margate and the same distance S.E. of the Naze), the original paper appearing in the *Ibis* for January, 1904. Mr. Clarke's conclusions were that (1) most birds, especially small ones, fly very close to the waves, and hence are very difficult to observe; (2) intersecting currents of the same species of birds could be detected; (3) no Continental migration whatever takes place from points North of East; (4) the power often attributed to birds of foretelling periods of fine weather suitable for the migration journey seems to be a myth; on several occasions they set out on a falling barometer, and were overtaken by bad weather. In conclusion, Mr. Robinson, quoting Mr. Seehohm's remark that in Siberia the chief migration tracks lay on the great river valleys of the Lena, Yenesei, and Obi, put forward the suggestion that the cross Channel migration route of the present time coincided with the site of an ancient river valley, and as modern geologists agree that such a river valley did exist, and that, too, probably since the advent of man, it would, in a measure, explain why birds of the present time follow that particular route.

WEDNESDAY, MAY 11TH, 1904.

British Trees.

BY

MR. G. CLARIDGE DRUCE, M.A. (OXON),
F.L.S.

(Author of "The Flora of Oxfordshire and Berkshire"),

WITH LANTERN ILLUSTRATIONS.

THE Lecturer first described the four classes of the Vegetable Kingdom,—Dicotyledons, Monocotyledons, Gymnosperms, and Acotyledons, in order to explain that only two of these, the first and the third, were represented in Britain; but he showed, in order to illustrate the growth of monocotyledonous trees, a photograph of the great Dragon Tree of Orotava, Teneriffe (*Calamus Draco*), which had been said was the oldest tree in the world, its age having been estimated at as much as 6,000 years, but the Lecturer was inclined to put it at not more than 2,000 years. The tree is now destroyed; from it was obtained a resin known as Dragon's Blood, much in use as a colouring agent.

The other tree illustrated was the Seychelle Island Palm, the fruit of which, known as the double cocoa-nut or *Coco de la Mer*, was for a long time the theme of much controversy, as the origin was unknown, the fruit being cast up by the seas on the Indian coast, was supposed by some to be a fossil, by others as the fruit of some gigantic water plant, until the discovery of the Seychelle Islands off the African coast explained the problem. These photographs shewed the comparatively simple stem of this class as compared with the branching characters of our forest trees; and this was true to a great extent also of the Tree Ferns, of which a photograph of *Dicksonia antarctica* was shewn. The height of a monocotyledonous tree, even of the Palms, was rarely over 250 feet, while Tree Ferns, even gigantic Tree Ferns, were rarely over 60 feet.

The Lecturer said that it was not quite easy to define what was meant by a tree. Morrison, the first Oxford Professor of Botany, included in his unpublished work, written about 1680, all woody perennials in his "Arbores," but the Lecturer said he should take as his standard a tree which attained the height of not

less than 30 feet. Of these the British Flora included nearly 40 species, but several were only doubtful natives ; but the introduced species were so frequent that he should be obliged to make some reference to them. He, therefore, shewed photographs of the Lime tree, which many authorities asserted was introduced into Britain during the Roman occupation, but which was now so common an object in our parks, promenades, and plantations. He referred to it as being the name of the great botanist, Charles Lind, better known in its latinised form as *Linnaeus*, and said how excellent a tree it was for planting in towns ; the odour so well known was curious from the fact that it was more pronounced at a little distance from the tree, when one got closer it was less agreeable and less powerful. Specimens of the Limes by the Thames, at Windsor, and at Dorchester were shewn. In passing, the Lecturer remarked that two species of Lime, the small and the large-leaved Lime, were supposed to be native trees.

The Oriental Plane was next described, and some botanists believed it was also introduced by the Romans, others that it was not brought to Britain until the 15th or 16th Century. This tree is also well adapted for planting in towns, since it bears the smoke better than most species. It is a native of the East, and was introduced into Sicily about 600 years before Christ, and was a favourite tree of both the Greeks and Romans. The photograph exhibited was from the large tree at Rycote, in Oxfordshire, where Elizabeth was kept for two years in practical imprisonment. The peculiar undulating growth of the branches was explained.

The Sycamore was then described as probably an introduced tree, but the date of its introduction was lost in remote antiquity. The tree was frequently planted about castles and farmhouses to give shelter, and in Scotland they received the name of doul, or grief tree, from the custom which once obtained of hanging a refractory vassal or captured foe upon them. Fine photographs of some trees at Inverary and Inverlochy Castles were shewn, as also one at Burford, in Oxfordshire.

Brief allusion was made to the native *Acer*—or Maple—which is such a plentiful shrub in the hedgerows in limestone districts, and which has the same character as its American relations, that is in showing such gorgeous colours in autumn. It was mentioned that there were trees 40 feet high in Oxfordshire. The wood was greatly prized, and the celebrated Maser bowls were made of it which now fetched such extremely high prices.

The Horse Chestnut was next mentioned. This tree was probably introduced in the time of Queen Elizabeth, as Gerard in 1597 alluded to it as a rare foreign tree. The flower and the manner of fertilization was described, and photographs of the avenue at Bushey Park, and of a tree at Dorchester, were shewn.

Brief allusion was made to the Wild Plum and Pear, neither of which could be considered true natives ; and then the Common Elm was classed among the trees which were not indisputably indigenous. By many authorities it was considered to be one of the species we owe to the Romans. The fact of its rarely being produced from seeds was mentioned, and the Lecturer said he had seen a seedling of it on a wall in Buckinghamshire. The tree is so frequent in Central England, that he thought it worth while to show a series of photographs in order to evince what a factor it was in our rural scenery. Specimens were shewn of the Elms at Bensington, the Childswell Elm near Oxford, the Elms at Medmenham, at Bisham, at Mongewell (which were figured by Strutt), at Great Marlow, the Broad Walk at Oxford, as well as some covered with hoar frost, which excellently brought out the repeatedly branching character so typical of our British forest trees.

The Sweet Chestnut (*Castanea*) was next described, and it was stated that this had the honour of being the largest tree known, the Great Chestnut of Mount Etna being no less than 66 feet in diameter, the next largest being *Taxodium Mexicanum*, the Mexican Cedar, which has been found 52 feet across, and therefore much larger than the tree of the Western States of America, the *Wellingtonia gigantea*, which, however, is less than forty feet through, even in its finest examples. Incidentally the Lecturer mentioned that this *Wellingtonia* was moreover not the tallest tree, although specimens 462 feet had been measured ; but these fell short of the *Eucalyptus amygdalinus*, the Peppermint tree of Australia, which had been known to attain the enormous height of 494 feet, therefore taller than any stone building in the Old World.

The Lecturer then proceeded to describe some trees which belonged to the class Gymnosperms, that is, in which the ovules were naked. Till recently they had been merged with the Dicotyledons but, as a matter of fact, they had more than two, sometimes, and not unusually six cotyledons. Moreover their alliance was rather with the Equisetums, and they belonged to that class of plants which was so largely represented in the Carboniferous era.

Of the introduced species which are now so plentiful, he first shewed and described the Cedar of Lebanon, which was brought into Britain from Syria between 1650 and 1680. Photographs of this magnificent tree from Beil House were shewn, and allusion made to the fine specimens at Blenheim.

The Larch next received attention. This deciduous conifer was introduced about 1620, and to Scotland in 1738, and a photograph of the original trees at Dunkeld was shewn—in a century one of them had attained a height of 100 feet—and it was stated that the Dukes of Atholl had planted on their estates upwards of 14,000,000 trees in a century. Photographs of the

Larch trees at Kenlochewe, at the Rollright Stones, and at Great Marlow were then exhibited.

The really native trees of Britain were next described. These number about 30, and include the two species of Lime already referred to, one species of Maple, two species of *Prunus*, the Cherry, or Gean, and the Bird Cherry, the Crab Tree, of which there is a fine avenue at Welford, in Berkshire, the Mountain Ash, with its beautiful clusters of scarlet berries, the Service tree, of which there are fine examples in Wychwood Forest and the White Beam tree, so frequent in the woods of the Chiltern Hills.

The Hawthorn was next illustrated by a photograph of a group at the Thames head, and by others on the chalk down near Streatley, in Berkshire; and reference was made to that early notice of the Hawthorn by Bishop Asser, of Salisbury, who described, towards the end of the ninth century, the great battle of Æscesdune, which took place on the Berkshire downs, near *Unica spinosa arbor*, which was a Hawthorn in the Hundred of Ilsley,—this Hundred being called the Hundred of the Naked Thorn in Domesday Book. Reference was also made to the Battle of Bosworth, when the crown of England was hidden in a Hawthorn bush, where it was found by a soldier, and taken to Lord Stanley, who crowned Henry VII. with it, and the Hawthorn thus became the badge of the House of Tudor, hence the proverb, “Cleave to the crown though it hangs in a bush.”

Reference was also made to the Glastonbury Thorn, which flowers about Christmas.

Passing notice was made of the Elder (*Sambucus nigra*), with its large cymes of white flowers and purplish-black fruits.

The Ash next received attention, and some fine examples of the Ash at Chatsworth, Haddon Hall, and Bulstrode were shewn. The wood was said to bear a greater strain before breaking than any other tree indigenous to Europe. The manner in which the fruits are fitted for dispersal by wind was also alluded to. That the Ash is native of Britain is shewn by the names,—Ashbourn, Ashbridge, Ashby, &c.

The Box tree is very local, and is, perhaps, only native of Boxhill, and possibly on the northern escarpment of the Chilterns in Buckingham and Hertfordshire.

The Elm, which is really native in Britain (the Wych Elm), is less common in the South than the one already mentioned; but the Tubney Elm, mentioned by Matthew Arnold, in Berkshire, belongs to this species which, probably, at one time was more frequent. The foundation of St. John's College, Oxford, was determined by the presence of a triple Elm. Sir Thomas White dreamed that he should build a college near a triple Elm, and repairing to Oxford he found one which seemed to answer to his idea, and he, therefore, built the college, and the tree existed to the end of the seventeenth century.

Brief reference was made to the Alder (*Alnus glutinosa*) frequenting stream sides in peaty districts; to the Hornbeam (*Carpinus Betulus*), which, although frequently planted in parks, appear to be really wild in the chalk districts of England.

By some authorities the Beech was considered to be an introduced tree, because Cæsar says that he did not notice it: but the Lecturer considered it to be one of our native species, and showed photographs of some large pollard trees in Burnham Beeches, and also some from the escarpment of Edge Hill, as well as some distant views of Beech woods in the Thames valley.

The Birch (*Betula alba*) was then described, and a photograph of a very lovely tree from Invernesshire, as well as others from Loch Katrine, Invercauld, and Killicrankie were shewn.

The Oak tree, particularly emblematic of England, was described as being one of the oldest trees, being able to exist nearly 2,000 years. The Queen's Oak, still flourishing in Northamptonshire, was mentioned in Domesday Book. Photographs of the Byron Oak at Newstead Abbey, of the Major Oak in Sherwood Forest, of the Radley Oak, and others were exhibited, and allusion made to the tree in Windsor Forest, which was a favourite of William the Conqueror, and of the celebrated one at Oxford, by which William of Waynflete founded Magdalen College. The Oak, although one of our largest trees in girth and in its spread of branches, rarely exceeded 70 feet in height. The use of the wood in shipbuilding, and it being the material of which the Round Table at Winchester was made, was alluded to, as well as its name being frequently represented in Britain as in Oakham, Wokingham, Woking, &c., testified to its being one of our native trees.

Several species of Willows were briefly alluded to; the chief of these is the White Willow, so frequent by stream sides, and which, if unpollard, will attain a height of 80 feet. The use of the wood for the manufacture of cricket bats was mentioned, as well as the process and effects of pollarding. Views of Post Meadow, Oxford, and of the Willows by the Thames, at Lechlade, and Wallingford were shewn.

The Poplar, of which we had one native and three or four introduced species, was then described, and photographs were shewn of the Black Poplar (a frequently planted tree in the Midlands) from Sanford Lasher. The Lombardy Poplar was by some botanists considered to be a fastigiate variety of this species. The truly native species is the Aspen (*Populus tremula*).

The native gymnospermous trees next received attention—they are all evergreen. The Yew (*Taxus baccata*) is one of the oldest trees known in Britain, and is supposed to attain an age of over 2,000 years; the one, of which a photograph was shewn, at Iffley is supposed to be coeval with the Church, and the one at Fountain's Abbey is supposed to be even older than the building itself.

WEDNESDAY, JUNE 8TH, 1904.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 8TH, 1904.

It is a source of no little gratification to your Council to be able to report that during this the 50th year of the Society's existence the Ordinary Meetings have been on the whole more largely attended perhaps than in any of the preceding years. The Library, which now numbers more than 2,500 volumes, and which on account of the rebuilding of the Public Library has been for some time practically closed to members, is now reinstated in the Reference Library. The books have been thoroughly overhauled, and some 70 volumes of periodicals have been added to it, as well as many others.

Owing to the retirement of Mr. Pankhurst from the Secretaryship, the duties of which he has performed for the last eighteen years, a small Committee is recommended to carry on the work.

The Council is much indebted to Mr. Caush for going through several hundred microscopic slides and renovating them.

The excursions which Mr. Davey so successfully conducted last year, but which circumstances obliged him to intermit, have already been resumed.

Among the Members which the Society have lost by death during the past year it is fitting that mention be made of Mr. J. H. Browne, F.R.A.S., who was one of the oldest Members of the Society.

The excursions have been as follows :—

14th May. To Tilgate Forest and Balcombe.

28th May. " Firle Park and Beacon.

11th June. " Ashdown Forest — Coleman's Hatch — King's Standing — Crowborough.

25th June. „ St. Leonards Forest—Hawkins Pond—Colgate Tower.

9th July. „ Steyning—Washington—Chanctonbury Ring.

and the Meetings of the Society, with the titles of the papers read, as under :—

15th Oct. “ Relationship between Poetry and Science ”—

Rev. FELIX ASHER.

4th Nov. “ Fossil Hunting in the Libyan Desert ”—

Dr. CHAS. W. ANDREWS, F.G.S.

3rd Dec. “ Structure and Form of Shells ”—

Mr. ED. CONNOLD, F.E.S.

20th Jan. “ Memory and its Diseases ”—

Mr. SYDNEY TURNER, M.R.C.S.

10th Feb. “ The Smaller Denizens of our Ponds, Lakes, and Rivers ”—

F. MARTIN DUNCAN, F.L.S., F.E.S.

9th Mar. “ The Evolution of the Horse ”—

Dr. A. SMITH WOODWARD, F.R.S.

21st April. “ The Birds of Brighton and Neighbourhood ”—

Mr. E. ROBINSON.

11th May. “ British Trees ”—Mr. G. CLARIDGE DRUCE, M.A.

METEOROLOGY OF BRIGHTON.

MONTH.	TEMPERATURE OF AIR DURING MONTH.			Number of Days of Sunshine.																	
	Highest.	Lowest.	Mean.	X.	N.W.	E.	S.E.	S.	E.W.	W.	N.W.	Cold.	Cloud.	Rain.	Cloud.	Rain.	Cloud.	Rain.	Cloud.	Rain.	
July,	1893	79° 2	61° 7	82° 7	2	2	1	1	6	9	5	5	—	229·91	1	1	1	1	1	1	
"	1877-1903	85° 0	60° 7	73° 0	70° 2	72° 0	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2		
August,	1903	73° 0	44° 3	62° 0	—	—	—	—	2	8	14	6	1	201·60	1	1	1	1	1	1	
"	1877-1903	89° 4	39° 9	73° 2	59° 5	64° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	
September,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	83° 2	39° 9	73° 2	57° 1	64° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	
October,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	87° 1	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
November,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	83° 5	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
December,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	87° 1	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
January,	1904	50° 4	25° 1	39° 6	20° 8	30° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	
"	1877-1903	63° 4	31° 2	51° 0	25° 1	39° 6	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8
February,	1904	51° 2	36° 0	40° 8	20° 8	30° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	
"	1877-1903	63° 5	31° 2	51° 0	25° 1	39° 6	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8
March,	1904	61° 2	31° 2	41° 5	37° 7	42° 8	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	
"	1877-1903	65° 0	31° 2	40° 8	39° 6	49° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6	39° 6
April,	1904	69° 8	41° 1	49° 3	49° 6	79° 4	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6	49° 6
"	1877-1903	75° 4	51° 2	47° 3	47° 3	88° 2	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3	47° 3
May,	1904	73° 4	51° 2	49° 7	49° 7	90° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0
"	1877-1903	80° 8	50° 8	49° 7	49° 7	90° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0	53° 0
June,	1904	73° 4	48° 7	58° 1	58° 1	73° 7	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1	58° 1
"	1877-1903	85° 0	50° 8	57° 0	57° 0	73° 7	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0	57° 0
Entire Year		79° 2	25° 7	60° 7	34° 3	84	33	22	13	34	49	108	87	81	9	190	34·34	42	1362·40		
Average of Years 1877-1903						30·2										166	26·74	74	1362·61		

MONTH.	TEMPERATURE OF AIR DURING MONTH.			Number of Days of Sunshine.																	
	Highest.	Lowest.	Mean.	X.	N.W.	E.	S.E.	S.	E.W.	W.	N.W.	Cold.	Cloud.	Rain.	Cloud.	Rain.					
July,	1893	79° 2	61° 7	82° 7	2	2	1	1	6	9	5	5	—	229·91	1	1	1	1	1	1	
"	1877-1903	85° 0	60° 7	73° 0	70° 2	72° 0	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	
August,	1903	73° 0	44° 3	62° 0	70° 2	72° 0	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	70° 2	
"	1877-1903	89° 4	39° 9	73° 2	59° 5	64° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	54° 9	
September,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	87° 1	39° 9	73° 2	57° 1	64° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	51° 8	
October,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	87° 1	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
November,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	83° 5	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
December,	1903	73° 0	39° 9	57° 1	52° 5	57° 1	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	52° 5	
"	1877-1903	87° 1	39° 9	73° 0	57° 1	64° 8	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	51° 9	
January,	1904	50° 4	25° 1	39° 6	20° 8	30° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	
"	1877-1903	63° 4	31° 2	51° 0	25° 1	39° 6	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8
February,	1904	51° 2	36° 0	40° 8	20° 8	30° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8
"	1877-1903	63° 5	31° 2	51° 0	25° 1	39° 6	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8	20° 8
March,	1904	61° 2	31° 2	41° 5	37° 7	42° 8	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7	37° 7
"	1877-1903	65° 0	31° 2	40° 8	39° 6	49° 6	39° 6	39° 6	39° 6	39° 6											

BRIGHTON AND HOVE NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 8th June, 1904.

We have examined the foregoing Accounts with the Vouchers and certify the same as correct.

*NOTE.—There is a sum of £100 2*½* per cent. Consolidated Stock standing in the names of the Hon. Treasurer and Hon. Secretary, and Mr. E. A. PANKHURST, as Trustees for the Society.*

HERBARIUM, 1902-1903.

Since the last Report, we have been able to add to the Society's Herbarium a number of interesting plants, as will be seen by the following list. Some are extremely rare ; e.g., *Bupheurum aristatum* is known to occur in only two English Counties, and *Wolffia arrhiza* has only lately been found in Sussex. An increased proportion are aliens, due to our having now most of the native plants and to the large importation of hay, &c., containing foreign seeds.

LIST OF NEW PLANTS.

<i>Alyssum calycinum.</i>	Downs, Patcham.
<i>Arabis hirsuta</i> , v. <i>glabrata</i> .	Dyke Hill.
<i>Bupheurum aristatum</i> .	Beachy Head.
<i>Sisymbrium Sophia</i> .	Eastbourne.
<i>Erepimum perfoliatum</i> .	Kemp Town.
<i>Bromus ariensis</i> .	Lewes.
<i>Wolffia arrhiza</i> .	North Stoke.
<i>Potamogeton coloratus</i> .	Eastbourne.
<i>Trifolium resupinatum</i> .	Found in many places in 1902.
<i>Melilotus sulcata</i> .	Aldrington.
<i>Plantago ceratophylla</i> .	Aldrington.
<i>Gastridium australe</i> .	Cuckfield.
<i>Oxalis stricta</i> .	Cuckfield.
<i>Juncus obtusiflorus</i> .	Eastbourne.
<i>Lolium temulentum</i> .	Dyke Road.
<i>Linaria repens</i> .	By Dyke Railway.
<i>Brassica adpressa</i> .	Glynde.
<i>Eructastrum Polichii</i> .	Glynde.
<i>Vaccinium Oxycoccus</i> .	West Chiltington.
<i>Calluna Erica v. incana</i> .	Washington.
<i>Campanula Rapunculus</i> .	Pulborough.
<i>Cicerach officianum</i> .	Pulborough.
<i>Pimpinella magna</i> .	Near Polegate.

T. HILTON,

Curator.

RESOLUTIONS, &c., PASSED AT THE 51st ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

"That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Report as to the Library, and the Curator's Report, be received, adopted, and printed for circulation as usual."

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

"J. E. Haselwood, E. J. Petitfourt, B.A., F.C.P., F. Merri-field, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., W. J. Treutler, M.D., F.L.S., J. P. Slingsby Roberts, W. Clarkson Wallis, and E. Alloway Pankhurst."

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

"Mr J. W. Nias and Mr. A. F. Graves."

It was proposed by Mr. ISAAC WELLS, seconded by Mr. J. H. GILKES, and resolved—

"That the following gentlemen be Officers of the Society for the ensuing year :—*President* : Henry Davey ; *Ordinary Members of Council* : Walter Harrison, D.M.D., F. Hora, B.Sc., G. Morgan, L.R.C.P., F.R.C.S. (E.), S. R. Penney, H. J. Mathews, J. Sussex Hall ; *Honorary Treasurer* : E. A. T. Breed ; *Honorary Librarian* : W. W. Mitchell ; *Honorary Curators* : H. S. Tooms and T. Hilton ; *Honorary Scientific Secretaries* : D. E. Caush, L.D.S., W. Harrison, D.M.D., F. R. Hora, B.Sc. ; *Honorary Secretary* : J. Colbatch Clark, 9, Marlborough Place ; *Assistant Honorary Secretary* : H. Cane."

It was proposed by Mr. WALLIS, seconded by Mr. F. R. HORA, and resolved—

"That the best thanks of the Society be given to Mr. E. A. Pankhurst for his assiduous attention to the interests of the Society as its President during the past two years, and for the many services he has rendered to the Society."

It was proposed by Mr. H. J. MATHEWS, seconded by Mr. MINTO, and resolved—

“That the sincere thanks of the Society be given to the Vice-President, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curators, the Honorary Auditors, and the Honorary Secretaries, for their services during the past year.”

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WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,
And whose Presidents and Secretaries are *ex-officio* Members
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Brighton and Hove Natural History and Philosophical Society.

1902.



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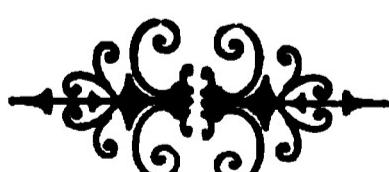
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**Natural History and Philosophical
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Abstracts of Papers

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

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SESSION 1904-5.

THURSDAY, OCTOBER 20TH, 1904.

The Functions of Music.

By THE PRESIDENT :

MR. HENRY DAVEY.

MR. DAVEY began with an allusion to the fact that the Society was now entering upon its second half-century, and further remarked that the occasion was noteworthy as a change in the government of the Society had been made, and the Scientific Secretary (a post so long and ably filled by Mr. E. Alloway Pankhurst) had been replaced by a Secretarial Committee, consisting of Messrs. Caush, Harrison, and Hora. As it had fallen to himself, not deeply versed in any branch of natural history or abstract philosophy, to begin this exceptionally important session, he had chosen the subject with which he was best acquainted, and had decided to give an address on the Functions of Music. This he endeavoured to bring under the domain of science, by a suitable treatment ; but confessed himself not too well satisfied with the result of his endeavours.

Herbert Spencer had written an essay on "The Origin and Function of Music," and, wishing to avoid all comparison with him, Mr. Davey viewed the subject from the standpoint of a practical musician, and dealt with the results which had been actually achieved rather than with speculations upon the abstract side of the subject. Herbert Spencer's essay was written nearly fifty years ago, and he was unacquainted with the latest developments even of that time. Consequently his essay, as regards materials, reads quite antiquated ; but his conclusion that the ultimate function of music will be to express ideas too subtle to be spoken —that we shall, as it were, converse by music instead of words when words fail us,—went into the future, and probably the very distant future. Mr. Davey took an altogether different course, warning his audience that he presupposed a certain knowledge of musical works and terms, just as a lecturer on science presupposes a similar knowledge.

Each of the arts had its own kingdom, whose bounds are fairly, though not strictly, defined ; each art had its advantages, defects, and limitations. The peculiar characteristic of music was that it was continuous, fluent ; while painting and sculpture were fixed, and portrayed one single moment's life. Contrast Leonardo da Vinci's picture of the Last Supper with Bach's setting of the words, "Lord, is it I ?" which are sung twelve times. "Both presentments of the subject are true, and exemplify the various functions of the arts," wrote Macfarren. Even rests, such as those just before the end of Handel's Hallelujah Chorus, are part of the music, part of the continuity.

Before entering on the main subject of the functions of music, Mr. Davey made some allusion to its various resources, speaking rather of composition, not of performance, and mentioned the different wave-motions which produce a different tone-quality by the varying predominance of the partial tones which accompany every note. A succession of notes played on a violin would have quite a different effect from the same succession played on a wood or brass instrument ; with combinations of several notes this obviously varied still more with varying combinations. This difference of tone-quality produced in the main what is called *colour* in music. We were obliged to use words derived from the sister arts. With the advance of music since the invention of the opera and oratorio about 1600, colour had become ever a greater factor ; and delicate gradations of *force* were now also employed. In the modern orchestra, with all its various stringed, wind, and percussion instruments, colour had attained an astonishing diversity. Speaking in generalities, harmony, melody, and rhythm were the internal resources of music, and contribute the materials for the *form* of a composition ; while the external resources of force and of tone-quality constitute its *colour*. "Music endeavours to display either structural or illustrative art ; that is, to attain artistic value either by the perfection of its composition or the accuracy by which it portrays something in external matters. In the latter case, music is apt to be sacrificed" ; and Mr. Davey quoted instances, including Signor Caruso's sobbing, instead of singing at the end of Canio's air in *Pagliacci*.

The functions of structural music were then considered, somewhat briefly, as the subject was highly technical. Mozart's explanation of the way he composed was a noteworthy point ; the great genius said that when he had finished a work he seemed to hear it, not from beginning to end, but all at once, and then anything unsuitable struck him, and he altered it accordingly. The cultivation of musical taste Mr. Davey considered to depend largely upon experience : a young musician was pleased by interesting details, a cultivated listener required the whole work to be completely balanced. But how did a mature musician know the difference between a commonplace idea which anybody

could have thought of, and an idea which was beautiful, and would remain beautiful, even when familiar? Mr. Davey confessed himself unable to say.

Illustrative music, as a topic more suited to an average audience, was dealt with at greater length. Only seldom could exact imitation of external matters be given. What was usually attempted is *suggestion*, by the use of sudden contrast. Often the suggestion required a great deal of make-believe on the part of the listener. Mr. Davey played passages from Bach's Passion-music supposed to be descriptive of scourging, and the servants warming themselves before the fire; also from Handel's Thick Darkness Chorus, which an auditor might not recognise without the words, though he would be able to tell whether darkness or light was intended. Motion in itself was not a very suitable subject for musical suggestion, but there are exceptions, as mill-wheels, and Handel's "Their land brought forth frogs"; while Dr. Strauss in *Don Quixote* had attempted to describe windmills. The fight between David and Goliath, from a descriptive sonata by Kuhnau, was played as a specimen of a different class.

Vocal music, using words, generally touched the dramatic side of the art, even if not entirely dramatic; consequently it belonged usually to illustrative rather than structural music, solo music specially so. Composers of concert-music rarely succeeded with opera, and *vice-versa*. Mozart, the universal genius, alone perfectly succeeded in combining both species; and even he only occasionally, his musical instinct generally leading him to repeat words and phrases against the dramatic sense of the passage. Wagner, who scarcely ever tried concert-music, had pointed out passages in his own works suitable to their place in the opera, but which might justly be blamed in abstract music.

Real literal *imitation* of external sounds was sometimes successful. "Alkan, in a pianoforte piece, imitates the moaning of the sea marvellously; Elgar, the youngest of English composers, in his oratorio, *The Apostles*, has exactly imitated the fall of Judas's pieces of silver on the pavement; Wagner has made the violins imitate the sound of scissors. While cannon-firing, galloping horses, and the smacking of whips can be well imitated, a thunderstorm cannot, and though attempts are frequent, they never rise above suggestion. The rippling of a brook, or the course of a river, and moving water generally, are tempting subjects often used." Mr. Davey instanced works by Smetana and Schubert. The moaning of wind reminded one of chromatic passages.

Turning to animated nature, specimens of bird imitations were quoted; also Mendelssohn's of the donkey's bray, and Strauss's of the bleating sheep in *Don Quixote*.

After a few words upon such rhythms as marches and dances, which might be recognised by their rhythms and suggested in other pieces, so that music, as it were, illustrated music, Mr.

Davey turned to what he called one of the most difficult problems of musical æsthetics, the use of the *Leit-motif*, or "guiding theme," the labelling of a succession of notes to represent some abstract idea, and using them with the convention that they really signify the idea. This invention was usually associated with Wagner's name, but there were earlier cases, notably Berlioz' *idée fixée* which he used throughout his *Symphonie Fantastique* to signify the lady he loves. Whether that style could give the same pleasure as finished structural art, was a question which depended on individual taste. Mr. Davey thought it inferior, because it was much easier to do. In Wagner's later works, the *Leit-motif* was worked up into a complex system, the *Nibelung's Ring* containing as many as ninety-two. Mr. Davey played some of these, and others from *Lohengrin*, *Tristan*, *Die Meistersinger*, and *Parsifal*. Such a theme should be heard in a recognisable form at any reference to it in the drama ; but in the *Nibelung's Ring*, which takes four evenings to perform, their number and complication made the task of both composer and audience very difficult. The *Leit-motif* might give occasion for great developments in the future ; but it undeniably gave terrible opportunities to the caricaturist and the sneerer ; and the symphonic poems of Strauss, who had depicted his own wife by a very trying and scratchy violin solo, had been much derided. If such matters were outside the real functions of music, they would speedily come to naught. At present they were very prominent.

Some mention was made of false imitation, such as using the words *high* and *low* in a wrong sense, which had been perpetrated even by the greatest composers ; and Mr. Davey concluded with the assertion that " Illustrative music is the foundation ; though, compared with the highest flight of structural music, it be of the earth, earthy, yet to the earth again music has, Antæus-like, to return when wearied-out, and requiring new vigour for a fresh enterprise. This is the state of the art at the present moment."

THURSDAY, NOVEMBER 17TH, 1904.

Half-a-Day on the Sea Shore.

BY

MR. E. T. CONNOLD, F.E.S.

(Illustrated by Lantern Slides.)

THIS lecture comprised a description of the habitat, habits, and appearance of many objects and creatures met with on the beach, rocks and sands.

1. *On the Beach*.—Attention was given to the flints and pebbles, and broken shells; then the fleas, flies, spiders, and beetles. An oyster shell was shown much perforated by the boring sponge. Boring molluscs were then discussed; the egg capsules of the whelk were shown.

2. *On the Rocks*.—Sea weeds were next considered and many excellent slides were shown to illustrate their structure. Anemones, barnacles, starfish, and sponges were also referred to.

3. *On the Sands*.—Razor shells, lug worms, the common squid, worms living in tubes, sea mice, &c., were discussed.

THURSDAY. DECEMBER 15TH, 1904.

An Evening with the Microscope.

ABOUT 60 slides were passed through the projective microscope lent by Mr. Caush; they consisted mainly of botanical, entomological and histological sections. The rest of the evening was spent by the members examining for themselves a number of slides under different microscopes supplied for their use by the Society.

FRIDAY, JANUARY 13TH, 1905.

Social Evolution and Public Health.

BY

DR. A. NEWSHOLME, M.D., F.R.C.P.

(Medical Officer of Health for Brighton).

THE lecturer commenced by saying that a review of the last fifty years afforded ample ground for congratulation on the prolongation of average life which had been secured, and on the great improvement in average comfort and well-being. The death-rate in urban districts (always higher than in rural districts), was now lower than it was 50 years ago in rural districts, and had declined from 22·5 per 1000 in 1854 to 16·2 in 1902. The wage-earning classes, who form the large majority of the population, had shared in the general improvement, whether we considered amount of wages, cheapness of food, or improvement in housing. The public health policy of the last 50 years had not only neutralised the rise in the death-rate which increasing urbanisation would have caused, but had secured an additional saving of 28 per cent.

The lecturer, albeit he congratulated himself on being an optimist as regards the efficacy of preventive medicine in improving the national health, could not shut his eyes to the fact that a large proportion of our population were still insufficiently fed, badly housed, and suffered from conditions producing ill-health and a shortening of life.

Consideration was then given to the natural laws by which the present position had been reached, and the future trend of those laws. The doctrine that life had been evolved through pain and struggle ("The whole creation groaneth and travaileth in pain together until now,"), stated very clearly by Malthus as regards man in 1798, in his "Essay on Population," and extended by Darwin to the whole animal and vegetable kingdoms, was now accepted as supported by universal experience, as was likewise the necessary corollary that without such struggle strength could not be maintained and degeneration must set in. The struggle for existence was a struggle between the living organism and the environment—those best fitted to the environment tended to survive, others to perish. The ratio of the fitness of an organism to the strain imposed on it determined its survival, and the value of the ratio was constantly being changed in

natural and social evolution by the variation of both factors. In plant life the ratio was affected mainly by alterations in the fitness of the organism, but instances were not wanting in which the organism likewise modified its environment. Such instances were mostly seen in co-operation between various organisms. Lichens are a mutual provident society of fungi and algae. The bacteria of the nodules of leguminous plants pay for their maintenance by fixing nitrogen from the soil and air, and supplying it to the plants. The beech thrives only when a mantle of the fungus *mycorrhiza* develops over its roots; the fungus, being fed by the beech, in return supplies it with certain salts, thereby dispensing with unnecessary expenditure of force on added rootlets. Again, between plants and animals there are many instances of useful partnership. Certain seaweeds are attached to the shells of marine crabs, the crab thereby simulating the appearance of a rock, whilst the seaweed secures multiplied opportunities of receiving food. Ants tenanting the "bull's horn" acacia tree obtain food and shelter from it while they defend it from enemies. Even beetles inhabiting manure heaps help each other in rolling up pellets of dung and burying them as larval food with eggs embedded in them. Still better known are the co-operative efforts to control their environment displayed by such animals as the bee, the ant, the beaver, &c.

In the evolution of man, the intelligent power to alter environment played a supremely important part, because he alone appeared to be capable of improving on the experience of his forbears. Although certain orangs pelted passers-by with nuts, and the chimpanzee cracked his nuts with a stone, man was the only animal employing tools of increasing complexity for his wants. He alone clothed himself and cooked his food. He had learnt also to press into his service the forces of nature and the organic modifications of plants and animals, as in cultivated cereals and domesticated animals. Environment for one class of animal was the same for other classes; hence the primitive method adopted by the strong in modifying this environment consisted largely in destroying the weak and appropriating their property. But that was not the only method employed, as instances already quoted clearly showed. In the various forms of co-operation seen in animals, there was a constant succession of acts which in man were counted as honesty, fidelity, justice, mercy, sympathy, and benevolence. In some cases, e.g., parental devotion, the act was done from an innate altruistic pleasure, thus showing "they follow the law, but know not the doctrine." There could be but little doubt but that the mitigation of the tendency to mutual destruction originated in a sense of the net advantage to be derived by the individual from mutual help. Upon this were based the foundations of society, and social evolution consisted substantially in its development.

The increase of reason and experience tended at first to intensify the struggle for existence, and to make human development ethically worse as it became more rational ; but now an altruistic conscience had come to mitigate this process. The destruction of man by individual man was condemned by an universal sentiment. The public conscience no longer allowed, at least in its ethical theory, one set of men to support and enrich themselves by procuring the degradation and suffering of others ; or, as Huxley put it, "It repudiates the gladiatorial theory of existence," and is directed "not so much to the survival of the fittest as to the fitting of as many as possible to survive." Such views were based on the application of rules of conduct, for the operation of which there was still a wide sphere open.

The adoption of altruistic principles had acted rather by creating a disposition to welcome measures on behalf of public health than by furnishing a practical basis for them. Support for such measures was given chiefly on economical grounds—a fact not to be regretted, since there was a limit to the resources of every community and a consequent duty to husband and apply them to the best advantage. Moreover, it was closely interwoven with the economic well-being of the community, and at times the ebb and flow of the public mind (and also one's own personal faith) seemed to throw doubt on this association. The lecturer regarded this as so important that considerations on which it was based were worth studying shortly, as also was the alternative view, viz., that influences, tending to improve the health of strong and weak indiscriminately, helped to preserve weaklings who would otherwise drop out, and, as a consequence, the average strength of the race was reduced and increasing unfitness laid up for future generations.

As an example of this line of thought, the lecturer quoted Professor Karl Pearson as follows :—"We have two groups in the community—one parasitic to the other. The latter thinks of to-morrow and is childless, the former takes no thought and multiplies. It can only end as the case so often ends—the parasite kills its host and so ends the tale for both alike." And elsewhere "the birth-rate of the better type of working men has been falling off more rapidly than the birth-rate of the nation as a whole." Mr. Balfour also argued at the British Association Meeting (September, 1904), that inasmuch as when men won their way from lower to middle rank their progeny diminished owing to later marriages, &c., "it seems that as the State contrives education so as to allow this rising from a lower to an upper class, so much does it do something to diminish the actual quality of the breed. . . . There is, or seems to be, no escape from the melancholy conclusion that everything done towards opening careers to those of the lower class does something towards the deterioration of the race."

Both these views the lecturer regarded as based chiefly on insufficient data. The birth-rate was not governed at present chiefly by postponement of marriage, neither were there grounds for saying that the birth-rate of the better type of workman had relatively decreased. Both writers seemed to ignore the fact that infantile mortality was commonly twice as high amongst the so-called "inefficients" as amongst those other grades of society with fewer children. There was no sufficient ground for thinking that in these respects the nation was worse than formerly, though there was ample scope for the adoption of practical means to secure improvement. Mr. Balfour's statement justified the inference that some kind of inferiority (of what nature he did not specify) was necessarily transmitted, but modern scientists inclined to the view that innate inferiority was the only form permanently transmissible, and so far from any innate inferiority being prevalent among the wage-earning classes, the lecturer stated that most medical men held that, given equally good education and physical conditions, there need be no fear of "deterioration" were the wage-earning to take the place of other classes. These two distinguished men, instead of taking a conspective view of the classes of whom they were speaking, had applied a microscope to relatively small and abnormal groups of society, and generalising therefrom.

The lecturer thought that a sound view of public health policy lay in wider considerations than were involved in the passages above quoted. It was an economical fact that the average fit man contributed more to the aggregate resources of the community than he dissipated in his own person. Many men of less than average fitness also contributed a surplus, but at what degree of unfitness equilibrium occurred was impossible to say, but it could be taken as certain that the average man of to-day was a valuable economical asset, and that probably only a very small minority were incapable of becoming so under proper conditions. In practice it was impossible to prescribe public health measures which should operate only in favour of the fit. When the efficient cause of disease arrived, it attacked both classes in the same manner, and any circumstance which lowered the resistance of a fit man increased the chance of an efficient cause of disease catching him in a susceptible condition—each successful attack left the victim less capable of resistance to further attack. The omission of measures to improve the resistance to disease, e.g., general sanitation, abatement of over-crowding, &c.,—and of measures to prevent access of infection and other causes of disease tended, therefore, not only to eliminate the chronically unfit, but to increase the number of transfers from the class of fit, or occasionally unfit, to that of chronically unfit, and therefore the chance of death of an attacked individual. Obviously the very strongest evidence of benefit would be required

before it could be regarded as economically advantageous to jeopardise the lives of individuals in the fit class, or to increase the chance of their transfer to the chronically unfit. In infectious disease the actual sickness of one person caused in itself greatly increased danger to his neighbour, fit or otherwise. To illustrate the effect of the erroneous view that influences for the improvement of public health might do more harm than good, the lecturer referred to "sunshine," and expressed the opinion that even the hardiest supporter of that view would hesitate before recommending measures for excluding the sun from dwellings in order to secure the elimination of the weaker individuals of a community. Hence the effect of public health measures could never give the chronically unfit the same chance of survival as the normally fit, and even if the survival of some of the unfit did reduce the rate of improvement of the whole community, it could not turn it into a deterioration. Hence the evolution of Society, stimulated and supported both by economical and ethical doctrine, had led communities to strive for the maintenance and improvement of public health, which was, as already stated, directed to increasing the fitness of the individuals who composed the community, and to the removal of any excessive strain on them due to their environment. As regards the extent to which the fitness of an individual could be modified, the lecturer summarised it by stating that (1) innate qualities of old standing in the race were largely permanent during the life of the individual, irrespective of environment, and were transmitted more or less permanently; (2) certain conditions due to post-natal environment of the future parents were probably capable of being transmitted by a parent to one, or perhaps two, generations, but under an altered environment were subject to modification in a more remote posterity; (3) innate and post-natal qualities, acquired through influence of environment, to a slight extent might be modified. Professor D. J. Cunningham had pointed out that there was a certain physical standard which was the inheritance of the race, and that however far certain sections of the people might deviate from it, through poverty, ignorance, squalor, and bad feeding, such deviation was not transmissible from generation to generation. "To restore, therefore, the classes in which this inferiority exists to the mean standard of national physique, all that is required is to improve the condition of living, and in one or two generations the lost ground will be recovered."

The fitness of an individual, as far as it was capable of being modified otherwise than by modifications of environment, consisted in the capacity to utilise the environment to the best advantage—a capacity primarily dependent upon education—a word which demanded a wider connotation given to it in the future than which was signified by it now, including as it ought to,

not only physical training, academic learning, and a theoretical knowledge of the facts bearing on fitness, but also a practical training in their application. In illustration of this, the lecturer mentioned the knowledge of food values, and their modification by judicious cooking and proper mastication, and maintained that although an exact estimate was impracticable of the extent to which assimilable food failed, after being eaten, to be assimilated, yet the percentage was probably higher than generally imagined, and if added to the amount wasted by uneconomical choice of food, was fully as great as the deficiency in the food supply itself of the working classes. Food that, while capable of being digested and absorbed, was swallowed without undergoing those processes, was not only a source of dyspepsia and indirect impairment of nutrition, but was as much a direct economic loss as if not eaten at all. Rendering food more assimilable was as much an addition to food supply as the provision of additional food, and to teach effectively the necessary rules to secure competence in choosing food, and use skilfully cheap and simple means of savoury cooking, would doubtless on any national scale be a relatively costly matter, involving, for example, national training of girls for some time after they had left school, but the cost on any conceivable estimate would be only small in comparison with the thrift of food introduced into the national habits and the improvement in national fitness.

The lecturer then pointed out that the main defect of our present day education was failure to teach habits. Life, without habits of self denial and determination to live well within the limits of one's income, was not only miserable for the individual but also mischievous to the community.

The second factor of the ratio determining public health was then considered, viz., environment, and as regards the "direct" means of modifying it, Dr. Newsholme stated that the present direction of public health legislation and administration had been reached by inquiry and study without stint, and that its results afforded ground for congratulation and encouragement to those who had helped to determine it; but that as regards the factors contributing to the "indirect" modification of environment, their consideration could not be disposed of so readily. Of these, the two most important were (1) Conditions of National Employment; (2) The Problem of Poverty and Destitution.

As regards the former of these, a great change had taken place during the last hundred years. The original relation of master and servant was one of unmitigated competition, and in quite modern times there was still a practically unrestricted liberty to the employer to exact from the artisan more than he could give without detriment to his health, and to give him less than was sufficient to nourish his family and him adequately. Children were employed at an age and to an extent quite inconsistent with their well-being and

development. The conditions under which labour was thus exploited were most insanitary, and the workers had to accept them with the accompanying hardships because they had no alternative. In 1825, the abolition of the Combination Laws removed one of the disadvantages under which workmen had laboured. The iniquity of child labour was swept away, and during the last 50 years there had been a steady extension of State intervention in the regulation of factories, workshops, mines, &c.,—an advantage not only to the workers themselves, but also to the economic gain of the industries concerned. At the present time, with freedom of combination, reduced hours of labour, and improved sanitary conditions, the two parties of Capital and Labour were arranged separately under conditions far more nearly approaching equality than they had ever before been. Collectively these parties have an interest beyond the arrangement of their mutual shares in the produce of their industries, their activities being directed to obtaining from their environment the means of livelihood, but the modern history of the relations of capital and labour seemed to show that first one side and then the other had lost sight of each other's well-being. Moreover, the means of existence of a community, outside a very short term of years, lie wholly in its future earnings, and since national energy at any time is a limited quantity, what was spent on internal struggle between those who ought to be co-operating reduced the quantity available for the struggle with nature and with competing earners, and even in millennial Utopia united humanity would have to continue its unending struggle with Nature, and would exist only by its success in turning her forces to its own service. To a dispassionate observer, the well-being of every unit in the community was a matter of importance to every other unit; work, the master of all, demanded men contented and fit, not half-starved and anxious, and required from them, during their hours of labour, keen and whole-hearted energy. Hence, in the conflict with environment, a high value must be attached to the development of the sense of the mutual economic importance of masters and men, and of their common rather than their several interests, and finally to the provision for those who fall for the time being in the industrial struggle.

The problems of poverty and destitution, the lecturer maintained, had the utmost importance to public health, which had a close connection with prosperity, since the latter furnished direct means of improving sanitary conditions. In existing conditions it was probable that the connection was far more directly due to the fact that improved health permitted the means of prosperity to be earned, and that contrariwise failure in health brought a large proportion of the population below the "poverty line." If there be included in the definition of disease, moral and mental disorders, intemperance, vice, sloth and shiftlessness, the

amount of poverty under any other heading was relatively small. The treatment of poverty had shown historically the same confusion between symptom and disease as appeared in earlier times in medicine, and illustrated the mischief and hindrance to real progress caused by the adoption of an empirical treatment of symptoms instead of a scientific treatment of disease. The 1601 Act directed against vagrancy declared wisely that no one able to work should receive relief without the exaction of labour. The settlement laws stopped the migration of workers from place to place, and in later reigns led to relief being given to multitudes of able-bodied poor without the exaction of labour. As a protest against the intolerable consequences of this inconsiderate benevolence, parish workhouses were provided where a residential labour test was enforced as a condition of relief, but in 1782 an Act was passed which prohibited Guardians from insisting on the able-bodied entering the workhouse, and threw on them "the duty of finding work near their homes for such applicants as profess to be able and willing to work, but are unable to find employment, and of making up any supposed deficiency out of the poor rates."

By the operation of this Act the reduction of pauperism which had been secured was converted into a rapid and alarming increase; an unofficial condition of misery was created and an impetus given to idleness and vice which resulted, by the Act of 1815, in the removal of the time limit for ordering relief and converted charitable help into an ordinary grant in aid of insufficient wages, and hence the wage standard fell. The commission of enquiry in 1832 found that in many places subsistence from poor rates was more easily obtained than by labour (Eastbourne poor rate was 13s. in the pound); that under such influences prudence and thirst were discarded; sobriety and temperance were left without encouragement, and that the whole nation was becoming demoralised and impoverished. The Act of 1834, by reviving the test of admission for able-bodied paupers, at once rendered wages absolutely separate from charity, raised the status of the wage-earning classes, diminished the number of improvident marriages, and caused a rapid decline of pauperism. Dr. Newsholme thought that at the present time there was evidence of reaction, and exemplified it by commenting on the fact that inadequate out-door relief was being given in an increasing proportion of cases and was officially encouraged.

Applying the principles of evolution to the cure of poverty, it must be conceded that the community, in the husbandry of its strictly limited energy, cannot afford to allow available energy to be wasted, whilst wisdom and the rules of right conduct equally direct that it should not adopt towards the poor (a class dissipating more than it possessed and earned) the attitude of extermination proper to a pre-social age. It has to turn them to account with

the least net expense of communal resources, hence it must adequately nourish them, and convert the resultant energy into work to replace as far as possible that dissipated in their support. But if the community cannot afford to lose the work the poor man produces while communally supported, it can still less afford to lose his permanent capacity for doing work, and if that capacity be suffering through physical, mental or moral disease, the community is bound alike in wisdom and in mercy to administer relief in such forms as will tend to remove the disease and not the symptom, viz., poverty. Experience in all forms of evolution had shown that exercise was essential to avoid degradation of a function, and also conscious effort to secure the healthy maintenance of these functions, e.g., capacity for work and right living which involved mental and moral qualities ; and the withdrawal of the stimulus to such effort would degrade the population, or render some permanent cripples. The state, therefore, must encourage its churches, clubs, circles of friends, families (organs of the whole community and subject to the same laws as control all other life) to exercise all these functions, on the constant use of which depend their strength and growth. Such in general terms was the result of applying to poverty the principles regulating any successful evolution ; in other words, such were the laws which could be broken only at the expense of the communal well-being. It was a favourite form of self-deception to presume that laws of nature would be held in abeyance to favour some simple or seemingly cheap solution of an important question. The ignorant could only demonstrate the fallacy of perpetual motion machines by a process of trial, tedious, costly, and too often ruinous, whereas the scientific man by the application of the law of the conservation of energy would do so in a relatively short time. The error of sociological devices, conceived in defiance of natural laws, would possibly take longer to demonstrate, but the ultimate result was certain, and the longer the delay the higher the cost of the unsuccessful experiment. The lecturer, in applying the above principle to State help which if given at all must be sufficient in amount, stigmatised out-door relief as unsound and sentimental—unsound, because the community had a supreme interest in preserving or creating the capacity which was thus abandoned, and because each case was infectious to the sound portion of the community ; sentimental, because it satisfied the sentiment of the giver rather than the needs of the receiver, and protracted the disease rather than remedied it. It kept the patient in his insanitary and overcrowded dwelling and encouraged him to endure prolonged misery through insufficiency of his total resources, when a satisfactory social arrangement would ensure him receiving support in exchange for a fair day's work, or help him to improved condition through his own efforts.

Dr. Newsholme strongly condemned the proposals for free breakfasts to underfed school children, and old age pensions to those who had not contributed to them. Whilst evidence of hunger in children was on every sound principle conclusive ground for giving them immediate relief, it was no ground whatever for neglecting to recover the cost of such relief from the parents. Further, he maintained the aged and destitute poor, who during life were incapable of providing for their old age through sheer poverty and sickness, and who were, therefore, clearly entitled to State help, would be found to be relatively small, hence any gratuitous pension scheme would, by lessening the cultivation of self-help, fail to satisfy any test of sound ethics or economy. It was the decadence of the Roman Empire which produced the disposition to give unearned "panem et circenses." Moreover, since the national charity fund, no less than the wages fund, was strictly limited, State charitable aid must be postponed until the capacities of the constituent communal organs—such as the poor man's claim on his neighbours and friends, on his club and other voluntary benevolent associations—had successively been exhausted. It would indeed be a direct economical advantage in the avoidance of overlapping to co-ordinate State interference in poverty with the work of orderly and voluntary benevolent societies.

As regards the "drink" question, Dr. Newsholme quoted Mr. T. P. Whittaker, M.P., that the average drink bill of the working classes was about 6s 1½d. per week per family, the bill for other classes being 15s. 3d., and stated that medical men were of almost unanimous opinion that the beneficial effect of alcohol was very slight and hence 25 per cent. of the income of the poor was spent over what was nearly always a useless and mischievous drug. It was not the function of the State to visit the sins of the fathers on the children, and the distress caused to an innocent child by its parents' intemperance must be remedied as promptly and as certainly as if it arose from any other cause.

The lecturer concluded his address by showing what great improvement as regards the problem of poverty had taken place in England during the last 30 years. In 1871 there were in England and Wales 46·5 paupers per 1,000 of the population, and in 1901 only 24·6. The number of officially destitute in proportion to the total population had greatly declined, but there was a doubt whether the total poverty of the country had declined commensurately. There could be no doubt, however, that there had been a great improvement and a further improvement must not be expected by applying the benevolent nostrums of untrained sentiment. "It would be far more important to work at the prevention of misery than to multiply places of refuge for the miserable" (Diderot). The sound treatment of poverty was assuredly preventive, and it was only cruelty to substitute a palliative for a

scientific treatment. The health of a nation was the crude supply of energy upon which the whole of its activities, its happiness, and its achievements must in the last resort depend, and this wealth had been increased by the attention which in the last fifty years had been given to public health, and all the encouragement derived from such results was needed when the work remaining to be done was contemplated.

"Does the road wind up hill all the way ?

Yes, to the very end.

Will the day's journey take the whole long day ?

From morn to night, my friend."

FRIDAY, FEBRUARY 17TH, 1905.

Weather during January, 1905.

BY

DR. W. J. TREUTLER, M.D., F.L.S.

DR. TREUTLER gave a brief but interesting account of the abnormal weather conditions which prevailed during the latter portion of January, and showed, by projecting on the screen lantern slides of the weather charts during this period, how the British Isles and N.W. Europe became the region of an anticyclone, the formation and dispersion of which he traced, and drew attention to the phenomena which usually accompany an anticyclone.

FRIDAY, FEBRUARY 17TH, 1905.

A Peep at Pre-Historic Man.

BY

MR. CORNELIUS ROBBINS, L.D.S.

IN detailing the history of the Harlyn Bay (Cornwall) discoveries, the lecturer stated that he was not an anthropologist, archæologist or antiquarian, but he was subject to fits of enthusiasm, and it was the result of one of those attacks of enthusiasm that he desired to place before the Members.

In August of 1902 a family holiday was spent in a most delightful corner of North Cornwall, a little place called Polzeath, on the coast line, half-way between Tintagel and Newquay. The place had been made famous in the writings of Baring Gould, for at this point on the sea coast was pitched the story entitled "In the Roar of the Sea," dealing with an age in which smuggling was a fine art, and Copper's name was a terror to the Custom officers. The place was interesting for its natural rugged beauty, its rock grandeur, its coves and caves so useful formerly for storing contraband, and its close proximity to St. Enodoc, the little church that for a long period was lost entirely under the blown sand, but which had since been dug out and restored, and in which services were held regularly during the summer months. In Baring Gould's story, the wedding of Copper and his unfortunate bride took place in the portion of the chancel from which the sand had been removed, and the entrance on that occasion was made through one of the windows.

The passage ran as follows : "Mr. Peter Trevisa (Peter was a family Christian name) was for twenty-five years Rector of St. Enodoc, on the north coast of Cornwall, at the mouth of the Camel. The sand dunes had encroached on the church of St. Enodoc, and had enveloped the sacred structure. A hole was broken through a window, through which the interior could be reached, where divine service was performed occasionally in the presence of the churchwardens, so as to establish the right of the rector, and through this same hole bridal parties entered to be coupled, with their feet ankle-deep in the sand that filled the interior to above the pew-tops."

Polzeath was seven miles from Wadebridge, and Mr. Robbins and his party frequently cycled over to friends who lived in that

old-fashioned town. A day's excursion was proposed with these friends to Trevose Lighthouse, and it was suggested that a look might be given at Harlyn Bay, where some ancient skeletons had been recently discovered. Harlyn Bay, a lovely, restful spot, was about nine miles from Wadebridge. Here the visitors found Mr. Mallett, who owned a newly-built house at this place, as well as a small museum, and to whom the credit of these discoveries was due.

In early life Mr. Mallett insisted on going to sea, but after a time, tired of a wandering life, he settled down to study in Germany, with the intention of entering the musical profession. Just as he was making his way his health broke down, and he decided on a tramping tour through Cornwall. He pitched his tent on the shores of the little bay, lived on the simplest diet, practically in the open air, and wore no hat, boots or stockings. His health was restored, and he left the place, but he returned later on with a charming wife to share the joys and sorrows of "Tamariska." In that year (1900) he bought a piece of land for the erection of a dwelling house, but while digging for the foundations at a depth of fifteen feet, a slate cist was reached, containing, in addition to a skeleton, characteristic implements of an early age. The cist proved to be one of many. Mr. Mallett had dropped upon a pre-historic Necropolis.

The discovery was communicated to several scientific societies, and a committee was formed to personally direct further investigations. The committee included such names as the Rev. S. Baring Gould, the Rev. W. Iago, Mr. Buddicom, F.G.S., and others. About two thousand tons of blown sand were removed before any of the interments were laid bare. So far more than a hundred had been examined. Some of the relics were distributed to various museums, and Mr. Mallett kept the remainder in his own little collection. In his grounds he had carefully teased out the sand of one or more of the cists, roofed them over with a sort of cucumber frame, and was thus able to show the crouched-up skeleton *in situ*.

Of one of these arrangements the lecturer showed a photograph, and mentioned that the crouched-up position of the skeleton, together with the many examples of polished stone and slate implements, seemed to point to the late Neolithic or early Celtic period. These slate implements were extremely interesting, and showed a considerable degree of skill in working; they consisted of scrapers, borers, piercers, and even needles or small piercers. So beautifully finished were these latter that one could easily pierce one's skin with them even now. Prof. Bullen, to whom he was indebted for some of his facts, said "Neolithic flint flakes and scrapers occur in the neighbourhood as well as in the interments; shell implements also occur, and are of a carved needle shape, they are made of limpet and mussel shells. The

local rock is Devonian slate, and by its abundance the inhabitants were probably determined in their use of it for their simple needs."

He (the lecturer) found that the crouched-up position of burial was very prevalent in that period, and Joly, in his "Man before Metals," said that the Assyrians, the Gauches of the Canary Islands, and the Peruvians practised the same form of interment. One peculiar feature of the Harlyn Bay interments was that most of the bodies were placed with the head pointing north, or to be more correct, according to the observations of Mr. Mallett, "the magnetic north." Considering that this was at a period prior to the invention of the mariner's compass, it was remarkable, but not very easy of explanation, except by reference to the Pole Star.

Most of the skeletons were resting on the left side; the right temporal bone was smashed in, presumably post mortem, in order that the spirit might have free exit on its way to the "happier hunting ground." For this journey certain provisions seemed to have been made. In some cists a stone weapon for protection was found, also materials that might be used for striking a light or making a fire, such as flint, felspar, and a sort of charcoal, placed usually on the abdomen or near the head. Often, and especially in a cist occupied by a lady, there was found a lump of crude oxide of iron for colouring and decorative purposes "when they got there." In case he should be doing the fair sex an injustice, the lecturer quoted from a German authority, the *Ueber Land and Meer*, published at Stuttgart, which, after describing a newly-discovered pre-historic burial field, near Worms, went on to say that "one find, near the top of the grave where there were no weapons, was most remarkable; it was a highly polished reddish stone, which, on closer examination, proved to be a lump of oxide of iron. Can it be that the dwellers on the 'Adlerberge,' near Worms, had practiced the same custom as the 'Nadovessier,' to whom Schiller attributes, in their death lament, these words :

' Colour, too, to paint the body,
Lay ye in his hand,
That with red he be resplendent
In the spirit land.' "

There were also evidences of a meal of food being left near the mouth. A slide, which the lecturer here showed, seemed to confirm this suggestion. A limpet shell was strongly adherent to the jaw of the skull, at about the angle of the lower lip. The specimen in question was obtained at a deep level, resting on the left side, and when Mr. Mallett teased the sand carefully out of it he considered that it pointed to the probability that after death a handful of limpets and cockles might have been placed near the mouth to ease the mind of the dead man's friends as to the need of refreshment, and that the limpet formed an

attachment and stayed there. Probably these people were fishermen as well as hunters.

The lecturer was fully aware that his theory with regard to this unusual specimen might meet with some questioning, and he read a letter from one who did not agree with his suggestion. The contention of the writer was that the body when buried would be in the flesh, and the limpet could not have lived to make attachment until the flesh had perished, while the position of the skeletons precluded the idea that they were denuded of flesh before burial. The writer went on to suggest that the skull belonged to some drowned sailor, which, having been found on the beach by some pious aboriginal, had been given decent burial. If this were so, he thought, it would throw a very interesting light on the feelings of these ancient people on the subject of burial.

In defence, however, the lecturer, while saying that one must not dogmatise in such a case, suggested that when the flesh disintegrated, thus placing the shell a trifle apart from the jaw, the nature of the fine sand in which the interment was made would be such that it would filter in and fill it up, so that most probably a thin layer of sand did intervene between the shell and the jaw. A future explanation might, however, make light of any of these theories, and the lecturer recalled how years ago it obtained in some of the text books that the ancient Egyptians were skilled in the art of filling teeth with gold. Many years after the theory had been accepted, the mummy on which the theory was based (owing to the evidence of gold on its front teeth) was further examined, and a pen-knife was tried on the gold surface, with the result that it proved to be a small portion of gold leaf with which the lips of certain mummies were decorated. The portion had adhered to the damp tooth, and as the lips had further shrivelled, the supposed gold filling was the more revealed.

Taking up the thread of his subject the lecturer said that quaint water-bottles filled with water were placed in Peruvian graves. He passed one specimen round among the Members, and read an extract from *The Connoisseur* of October, 1901, describing these vessels:—"These were supposed to contain the fluid *and* solid refreshment that was to sustain on their journey those destined for the country 'from whose bourne no traveller returns,' and were buried with chiefs and other important personages. The artistic spirit of the artificers seems to have taken the direction of perverting the human form into all kinds of monstrosities but it is noteworthy that they preserved a facial type, which may, no doubt, be taken as to some extent representative of that which existed in their time and locality. It is worth noting that in several instances the maize discovered in the vases has continued in such good condition that it has germinated on being planted." The lecturer added that Mrs.

Tweedie, in her "Mexico as I saw it," stated that even to-day corn in the cob was placed near the mouth of the corpse.

The Harlyn Bay graves were found in regular lines, and in some cases four cists had been super-imposed ; probably through the centuries, during which the place was used for interments, the sand encroached and covered up the lower tiers. There were a few circular cists made up of two compartments, and in these cases the skull and some of the limbs seemed to have been severed before death. Prof. Bullen thought that possibly these might be connected with some sacrificial ceremonies.

The lecturer said that the dental phase of the skulls in Mr. Mallett's little museum particularly interested him. As a result of a short examination of the collection, a paper was read before the Odontological Society in February of 1903, when it was hoped that he would go on with the investigations, especially in regard to the alterations that had taken place in the skulls, jaws, and teeth since those early times. He was able to enthuse a young Cornishman, living in London, to accompany a late President of the Odontological Society and himself for a week-end to Harlyn Bay. Before going down, however, a learned Member of the Camera Club, Dr. Leon Williams, lent them a splendid instrument, his own invention, for measuring skulls. In this he (the lecturer) thought that Dr. Williams showed a generous and truly scientific spirit. By means of slides, the lecturer showed the working of the ingenious " craniometer," which was suited to measuring skulls from fixed points either in the living or dead subject.

The special trip down to Cornwall took place on March 20th, 1903. After concluding their work in the museum, taking notes, measurements, and exposing plates, they went out and built up a screen of four or five blankets to keep off the wind and sharp, cutting sand, and then, working like any navvies on the line, they tried for all they were worth to find a cist. Many tons of sand they shifted, but to no purpose, their total find after six hours' hard work being one ox's molar, a knuckle bone of some sort, and a piece of slate that might possibly be called a pre-historic scraper.

Now, as to the scientific results of their little trip. Up to the present they had not been startling, although it was true that a second paper had been read before the Odontological Society. Roughly speaking, one might say that modern life, with its much-cooked food and made-up dishes, the terrible knife and fork invention, the rapid rate of living, the saving of weakly ones by medical science (who saw fit to breed their own kind in another generation), all made up a total which, in matters relating to the dental structures, was a dear price to pay for modern civilization. The lecturer compared skulls found at fifteen feet level with a single skull found at but a spade's depth. He pointed out the

difference in structure, the non-erupted wisdom-tooth of the latter, as well as the crowding and over-lapping of the upper teeth, and the fine frontal development. It was scarcely necessary to add that a Roman coin was found near this skull, to conclude that it belonged to an individual who bore marks of civilization, probably a Roman.

No very valuable deduction could be made from the small number of skulls they had to work from, but he firmly believed that some good would result from the application of Dr. Leon Williams' measuring instrument, when used, and the results tabulated on a large number of skulls of various types. It would be interesting to learn how through the ages the type of jaw had altered, and in what way or ways the environment of the creature was reflected in these structures. Dr. Charters White had indicated the character of food of these early people by his analysis of the tartar of some authentic specimens, and this induced him (the lecturer) to ask Dr. Charters White to experiment upon some tartar taken from a specimen sent to him by a friend who found a portion of jaw teeth near this spot, but the result of the examination added to their previous doubt as to that specimen being really very ancient.

In considering the sidelights thrown upon the possible belief in a future state by these primitive people, the lecturer read a paragraph from the *St. James's Gazette* of March 4th, 1904—a paragraph which was intensely interesting when viewed in the light of recent advances in the methods and ideas of the Japanese people: "It was a custom in old Japan to bury living retainers, servants, and even horses, upright in a circle round the grave of a member of any imperial or noble family. The heads of these poor wretches were left exposed, and their cries of agony during their lingering death could be heard night and day. This awful custom was changed by a tender-hearted ruler in the second year of our Christian era, rough clay images being substituted for the living beings; but so late as A.D. 646 another Emperor had to legislate against the recurrence of such living burials."

It was difficult to conceive that there were districts in India where the "suttee" or "good wife," was even now burnt on her husband's funeral pile. Tylor, in his "Anthropology," writes: In Europe, long after the wives and slaves ceased thus to follow their master, the warrior's horse was still solemnly killed at his grave and buried with him. This was done as lately as 1781, at Treves, when a General named Frederick Kasimir was buried according to the rites of the Teutonic Order; and in England, the pathetic ceremony of leading the horse in the soldier's funeral is the last remnant of this ancient sacrifice. Other quaint relics of the old funeral customs are to be met with. There are German villages where the peasants put shoes on the feet of the corpse (the hell 'shoon,' with which the old Northmen were

provided for the dread journey to the next world), elsewhere a needle and thread are put in for them to mend their torn clothes, while all over Europe (at an Irish wake for instance), the dead has a piece of money put in his hand to pay his way with."

It was interesting to note that at the grave level at Harlyn Bay, near the cists, were found remains of the ox, sheep, horse, and pig, which seemed to prove that these creatures were to some extent domesticated and used by the occupiers of the cists. They were also shown some grass seed that had been found in a sort of closed vessel, probably placed there many centuries ago. Mr. Mallett had experimented with this, and stated that it was still fertile, and he had produced a small crop of grass from it.

The lecturer here read a letter he had just received from Mr. Mallett, in which he said that the two most recent finds were the strange cists uncovered in the autumn. Nobody could account for the strange arrangement of the skeletons, and no certain clue could be gathered as to what the survivors meant by so singular a method of interment. They remained a mystery. Prof. J. Beddoe, however, considered the remains to be more distinctly neolithic than anything yet found. Both cists were rounded in shape, and were constructed of lumps of spar and slate, the interstices filled up with soil, showing "construction" as distinct from the usual slate slab graves. The larger cist (6ft. 3in. by 5ft. 9in.) contained the remains of two mortals, so far as yet known, both of whom were decidedly dolico-cephalic (longheaded). The skeletons had been absolutely dismembered, a skull being at each end of the cist, and each smashed in on the right side; the lower jaw was missing in each case, and the leg, arm, and other bones, fantastically deposited about the gravel, with intervening layers of slate rubble. Skull and crossbones were clearly discernable—magnificent teeth in each upper jaw, one tooth being more than an inch and a quarter in length.

In the smaller cist, continued Mr. Mallett, the skull was also smashed in on the right side, and the lower jaw had been placed at the back of the skull. Only the skull, jaw, and shoulder-blade, humerus and finger bone, were observable, all resting on a large slab, which, he fancied, separated the rest of the skeleton.

The seeds were found at about eight feet below the present-day surface, in a kind of chest made of slate, a fireplace being at the side, and midden remains all around; this sort of slate chest was actually in the midden, as part of it. *Convolvulus*, too, from the graves had germinated. He took it that the seed was stored, and, the sand having accumulated over the existing surface, it retained its fertility in suspension until it was unearthed. It was sprouting freely around the chest soon after they broke into the spot. The sand seemed to hermetically seal any such deposit, preserve the bones, and play other strange pranks.

Sufficient, continued the Lecturer, had been said to prove

that these were ancient burials, but it was difficult, or even impossible, to assign any exact date to these remains. Neither was it wise to presume that all the theories built up around these discoveries were correct.

Samuel Laing, in his "Human Origins," said : "The preservation of human remains depends mainly on the practice of burying the dead. . . . Now it is not until the neolithic period that the custom of burying the dead became general, and even then it was not universal. In many nations, even in historical times, corpses were burnt, not buried. It was connected, doubtless, with ideas of a future existence, which either required troublesome ghosts to be put securely out of the way, or to retain a shadowy existence by some mysterious connection with the body which had once served them for a habitation. Such ideas, however, only came with some advance of civilization, and it is questionable whether in paleolithic times the human animal had any more notion of preserving the body after death than the other animals by which he was surrounded. . . . A great many caves which had been inhabited by paleolithic man were selected as fitting spots for the grave of their neolithic successors, and thus sometimes the remains of the two periods became intermixed."

Concluding, the Lecturer said that if such an authority dealt with the matter in such a careful way, he would not presume to be dogmatic in any of the statements he had made. There were difficulties in attempting to "lift the veil" from the shadowy past, but it was a fascinating occupation, and, as with the past, so with the future, the desire to "lift the veil" was almost universal. Imagination must have its rightful sway, and if we had been interested in trying to spell out the obscure writing of a letterless age, how much more would our successors in the distant future revel in the relics left behind by this ancient capital of a mighty Empire, when its "cloud-capped towers, its gorgeous palaces," had passed away !

Into Macaulay's picture of the New Zealander sitting on London Bridge, the Lecturer introduced a second figure—a companion who, looking over the New Zealander's shoulder, should exclaim, his face beaming with joy, "Eureka, I have found it !" and, pointing to a bright red spot on the ground plan of London, near the ruins of St. Martin's Church, say with some authority, "That was once the happy home of the celebrated Camera Club."

At the conclusion of the lecture a collection of paleolithic and neolithic implements was shown, some of the specimens being very interesting.

SATURDAY, FEBRUARY 25TH, 1905.

The 'Booth' & 'Monk' Bird Collections.

BY

MR. ARTHUR GRIFFITH, M.A.

(At the Booth Museum).

THE Members of the Society visited the Booth Museum, and during the afternoon Mr. Arthur Griffith, M.A., read a paper, in the course of which he alluded to the fact that the Booth collection of birds, now that it had been extended by the Corporation acquiring the "Monk" collection, was the finest collection of British birds in the kingdom ; whilst the mounting and casing of the specimens to illustrate as far as possible their natural condition were unique.

THURSDAY, MARCH 16TH, 1905.

The Evolution of Artillery,

BY

COL. EDGAR KENSINGTON, (LATE) R.A.,

Formerly Professor of Artillery, Royal Military Academy,
Woolwich.

THE Lecturer commenced by observing that the association of the word artillery (derived from French artiller—to work with art) with guns was not always correct, as in the Bible Jonathan signalled to David with bows and arrows : but it was now applied to those weapons used in the art of war for throwing missiles to a distance, as contrasted with the pike, battle-axe, or bayonet, used only for hand to hand fighting, the rifle being exceptional as it accompanies the bayonet. In all fighting, from the remotest ages, victory has been obtained by hand to hand

the superiority of the Krupp breech-loading steel gun was definitely established.

The advantages of breech loading were then detailed thus :—

- (1) Larger charges of slow burning powder can be used, since the guns are longer.
- (2) These large charges can be packed in a more compact way in chambers of considerably larger diameter than the bore. It is well known that long charges produce a wave action which occasions irregularities of pressure.
- (3) Loading is more rapid. This culminated in the adoption of quick firing guns.

And the Lecturer stated that our modern guns were breech loading, made of toughened steel, having a great comparative length, with a muzzle velocity of 3,000 feet per sec., which gave them a longer range, flatter trajectories, and much greater accuracy, and quoted instances exemplifying the importance of length of range : (1) At Elandslaagte, General French, with the Natal Artillery Volunteers and their 7-pounders, was powerless to dislodge a party of Boers who had cut the line between Ladysmith and Dundee, having been outranged by another party of Boers who opened fire on him and compelled him to retreat ; (2) at siege of Ladysmith, the 6 inch Creusot guns of the Boers planted on the surrounding heights were made to keep their distance by a couple of 4.7 inch guns belonging to the Royal Navy ; (3) in the Japanese war the Russian field guns appeared to have ranged further, while the Japanese guns were lighter and more mobile ; and although the Japanese captured several Russian field guns they were useless, as essential fittings had been removed ; but the Japanese secured patterns of these lost fittings, made them, and last February they used them against their former owners at Taling Pass, east of Mukden, and completely outranged them. To the Boers belong the credit of first bringing into the field far heavier pieces than had ever been dreamt of before in connection with a field army. We have followed their example in associating a Howitzer Brigade and three Garrison Companies having 4.7 inch guns with our Army Corps. Moreover during Boer war quick firing guns and pom-poms (quick firing 1 inch guns) were first used ; the latter are now attached to our Cavalry Brigade.

As regards quick firing guns, the Lecturer emphasized the following points :—(1) The recoil must be nullified or absorbed so that the gun may be loaded while it is being fired ; (2) breech action must be most rapid, one action being sufficient to open or close it, the empty cartridge case being also thrown out by the act of opening ; (3) ammunition must be enclosed in a brass

case having its own means of ignition ; and stated that our service had now adopted 18½-pounders quick firing guns for field artillery, calibre 3.3 inches, in place of former 15-pounders of 3 inches calibre, and the Horse Artillery are to have 13-pounders of 3 inch calibre. In connection with this the Lecturer drew attention to the question of "gunpower" and "mobility," and stated that mobility was affected more by the weight of the ammunition than by the weight of the gun, and thought that 18 ammunition wagons instead of nine would have to accompany each battery, which gave 150 rounds per gun, and these could be fired off in about 10 minutes. After a brief explanation of the principle of Watkins' "Telemeter" or range finder, telescopic and automatic sights, and of the modern methods of "gun laying" and "position finding," Colonel Kensington concluded his address by numerous references to military history of the advantages gained in modern warfare by the judicious use of artillery, selecting incidents from the American civil war (1861-5), the Prussian and Austrian war (1859), the Franco-German war, the Russo-Turkish war, the recent Boer war, and the Russo-Japanese war.

FRIDAY, MARCH 24TH, 1905.

A Tour in Spain.

BY

MR. E. PAYNE, M.A.

Illustrated by Lantern Slides.

MR. PAYNE made a tour in Spain with his camera and gave a brief account of the towns he visited, and showed slides of typical Spanish landscapes, the chief buildings, etc. He started from San Sebastian, then visited Pampluna, Barcelona, Tarragona, Murcia, Granada, Malaga, Seville, Cordova, Toledo, Madrid, and Burgos. Some of the slides were taken by the "Sanger Shepherd" process of colour photography, and the excellent results obtained were much appreciated.

FRIDAY, APRIL 28TH, 1905.

The Evolution of the Vertebrate Skull.

BY

JAMES THORNTON CARTER,
M.R.C.S., L.R.C.P.

Illustrated by Lantern Slides.

THIS Lecture was devoted to a careful study of the anatomy and development of typical skulls, considered in their zoological order. Fishes were first considered, and slides of the skull of *Amphioxus*, and certain specimens of Elasmobranchs, Ganoids, Dipnoi, and Teleostei were shown and explained. In a similar manner, skulls of certain Amphibians, Reptiles, Birds, Mammals, and finally Man were considered, and their respective differences pointed out.

THURSDAY, MAY 18TH, 1905.

History of the South Downs,

BY

MR. J. H. A. JENNER, F.E.S.

MR. JENNER began with a reminder of what Gilbert White said of the South Downs after travelling on them upwards of thirty years. "I still investigate that chain of majestic mountains with fresh admiration year by year; and I think I see new beauties every time I traverse it." Varying in thickness from 800 to 1,000 feet, the Sussex Downs had their origin in a chalk formation at the bottom of a deep ocean, and must have taken many thousands of years in formation. The strata, proceeding upwards, consisted of the lower greensand, gault, upper

greensand, chalk marl or grey chalk, lower chalk or chalk without flints, and upper chalk or chalk with flints. The chalk rested upon various formations according to locality, but in Sussex it was on the Wealden. Once it was uniformly spread over this, but the Wealden formation had been elevated, together with the chalk above it. The chalk had been severed by the anticlinal ridge of the Weald and separated into the North and South Downs, this fracture being evident from the fact that the North Downs have a steep face to the south and the South Downs a steep face to the north. The South Downs had rifts through which rivers flowed—probably originally fissures caused by unequal raising—but now widened and modified by the flow of the rivers.

On the chalk was originally a considerable quantity of tertiary deposits, but these had mostly been removed by denudation. Their remains existed in many places as a re-deposit—such as the elephant bed between Brighton and Rottingdean, and the coombe rock and other beds near Portslade and Chichester. A few layers of the lowest series—the so-called Woolwich beds—remain *in situ* at Newhaven Fort and Seaford Head. The chalk itself was mainly composed of small organisms which, dying, fell to the bottom of the sea—slowly forming a muddy deposit and enveloping the remains of fishes and other sea animals. There is, said Mr. Jenner, supposed to be a similar process going on in the Atlantic at the present time. The enormous amount of time necessary to form such an immense thickness of material as the chalk might be easily imagined, not only from the slowness of the accumulation of the material, but from the numerous changes in the forms of animal life which occurred from the base to the surface, changes which were remarkable and progressive. After an incidental reference to the presence of flints in the upper beds of chalk, to the large use of chalk for building purposes in mediæval times and for lime in modern times, Mr. Jenner said the South Downs probably sloped gradually towards the south at the time the Channel did not exist and England joined France; but the bases of the hills had now been cut off by the sea, and the white cliffs of Albion provided in Beachy Head and the Seven Sisters some of the finest scenery in the South of England.

What the condition of the Downs was when the chalk first emerged from the sea was not known,—probably the elevation was gradual, and may have been in progress thousands of years. Of course, at first it was an absolutely sterile surface, gradually rounded by the action of water, which had given us the beautiful rounded contour. Then, probably, followed the lower cryptogams and other first occupants of bare soils,—until we arrived at the present botanical conditions. He thought they might safely say that plants arrived before animals or man, and evidently there was some division in the direction of arrival, as some plants

arrived on the northern range of downs which did not exist on the southern range, and vice versa. Remarking that every drop of rain that fell affected the shape of a chalk hill, though the change worked slowly, Mr. Jenner said it had been calculated that a drop of rain falling on a chalk hill to-day would not reach the usual depth of the springs for a hundred years. He did not, of course, refer to rain falling into a fissure, but to the slow percolation of rain drops, and he suggested that the people of Brighton might be now drinking water which fell a hundred years ago,—quite a "Vintage Water."

After vegetation came animals,—man, probably, in the condition of the lowest savages of the present day; certainly with no ideas of machinery or motors, but with a perception of form and usefulness, as implements of the early stone age in the Brighton Museum would show. It was once thought there were no men of the Palæolithic age in Sussex, but the discoveries of Mr. R. Garraway Rice had provided evidence of his existence both at Portslade and Chichester. Neolithic man was known by his weapons, and these, Mr. Jenner reminded his hearers, occurred in enormous numbers on the Downs, and were much more carefully and finely made than those of the Palæolithic age. He recalled the paper Mr. Toms had read on discoveries of flint instruments, observing that the great "Sheffield" flint knife and hammer factory of the South appeared to have been at Cissbury, from which site there were many specimens in the Museum. At Cissbury the chalk was tunnelled to obtain the fresh flint, which chips so much more easily than that which has been lying on the surface. Other centres he had found were one west of Newhaven, where the flints were evidently obtained from the sea cliffs as well as from some pits, and the well-known district near Eastbourne. These flints appeared to have been bartered with natives of other parts, but from the amount of remains and débris that could even now be found, the business must have spread over many thousands of years. Mr. Jenner also quoted from Professor Boyd Dawkins' "Early Man in Britain" a reference to the activity and fine workmanship at Cissbury.

What language these people used, continued Mr. Jenner, we know not, but it is probable that they tilled the ground to some extent, and the Downs furnished suitable light soil for this. The Weald being covered with forest, they also hunted game and wild animals, as evidenced by their arrow-heads and spearheads, and as, occasionally, some of these have been found as far away from the chalk as Crawley, they must have had an off-day's hunting and shooting at times. The question how these early peoples lived on our Downs without a water supply had always been a puzzle, but, probably, said Mr. Jenner,—as is well-known of South-African tribes, such as the Zulus,—they were exceed-

ingly fleet of foot, and thought nothing of moving many miles in a day down to the nearest brook or river. Dealing next with a recently published book on "Neolithic Dewponds and Cattle-ways," in which there are references to the Cissbury and Chanctonbury encampments, the speaker said he did not doubt that dewponds may have existed in Neolithic times, but he did not think there was any evidence. Also it was practically accepted that the hill camps he would next refer to belonged to the Bronze age. The splendid ramparts at Cissbury had no reference whatever to the wonderful Neolithic pits which were scattered widely both inside and outside of the more modern entrenchments. Some of the galleries which were explored some time ago passed right under the southern rampart.

There were many of these camps on various prominent parts of the Downs. They appeared to have been harbours of refuge for the civil population, as well as defences against enemies for the fighting population. They were in every case very cleverly constructed, with outworks covering the contours of the slopes. Cissbury, Chanctonbury, Ditchling Beacon, Hollingbury, Devil's Dyke, White Hawk Down, Seaford, Caburn, Birling, and others might be mentioned, and they seemed to have been placed in positions for easy communication by signalling—as was evidenced at the late Jubilee celebrations by the numerous beacon fires that could be seen from any given point. The ancient paths which lead up to these hill tops are often called borstalls, which is said to be derived from the British, meaning "hill path"; but the hills are covered with ancient paths leading in all directions—mostly grown over with grass—many leading to what is now "nowhere," but which may have been an important place in Neolithic times. "Cattle ways" they were termed in the book he had alluded to. Perhaps this was right; but not always. There is a very ancient path leading from Brighton to Lewes, and passing over Kingston Hill. It is called the "jugs road"—jugs being the colloquial name for the Brighton fishermen, who travelled that way with their goods to Lewes, &c. There are also natural tracks caused by sheep, &c., which may be seen well on any steep hill side.

There were other marks on the Downs with which he might briefly deal—cultivation marks. They were very evident in many places, especially on the Cliffe Hill, at Lewes, also near Alfriston, and at Littlington. There were also some between Lewes and Brighton. These are supposed to have been caused by the continual ploughing of a furrow literally beginning at the top of the holding and finishing at the bottom, and they also indicated the beginning of village communities, and what was now understood as allotments. He was inclined to think, however, that this was not a complete explanation. That these early traces, as well as the encampments, should be so evident after the enormous

lapse of time was astonishing, and shewed the very slow process of aerial denudation. At present Sussex did not seem to possess any early structure analogous to Stonehenge, or allied to the solitary one in Kent called Kit's Coty House. But on the Downs at one time were many of the sarsen stones, derived from the strata above the chalk, and stranded at various parts. Many of these sarsen stones might be seen at Stanmer and Falmer, collected from their original sites. He had often wondered if any archaic inscription could be found upon them, such as the well-known cup and ball markings.

Having referred to ancient figures cut in the Downs, like the Wilmington Giant, which figures had always been a puzzle, he said there was, on the steep slope of the Cuckmere Valley, below Hineover, a very rough cutting resembling a horse, which is not recorded in books on the subject, but which was kept clean by youths of the past generation, shewing that there must have been some tradition carried down about these things. For himself, he attributed these things to a very early stage of religious culture, but, as a fact, these hill carvings were mysteries, and they occurred nowhere else in Europe. There was a cross cut on the hill side above Plumpton, near Lewes. Some thought it was a record of the Battle of Lewes, but he saw no reason to think so. He must not omit to say that on the Downs we had remains of the burial places of the early peoples who lived in the neighbourhood. Most persons who had walked the Downs had come across circular mounds (generally, unfortunately, with a depression in the centre). These tumuli, probably all of the Neolithic age, enclosing the remains of some chieftain, were opened with very little scientific accuracy early in the last century. Urns and other things were found in them, but if more care had been taken we should have learnt more of these early people. There were not many "long barrows" on the Southdowns, but there was one above the Coombe, at Lewes, and one above the Wilmington Giant. These were usually supposed to be of the Bronze age. He could not discover that anything allied to the dene holes of Kent had been found on the Southdowns, unless the filled up pits at Cissbury are of the same character; but, as the Society noticed a year or two ago, workings very similar were used for raising stone in the Weald of Sussex.

Succeeding the Bronze age came the Iron age, and iron was in use when the Romans landed in Britain and captured the Downs. Boadicea, we were told, had a chariot with iron scythes on the wheels. When the Romans arrived,—those tactical Japanese-like adventurers,—they seized the camps and best vantage grounds of the Downs. They ate oysters on Cissbury. The eating of oysters was a peculiarly Roman trait, and from the size of the shells they were not inferior. Traces of their

sumptuous dwellings occur at Bignor, at Eastbourne, &c. Their burial grounds occur at Seaford and in other places. He emphasised the remarkable way in which certain positions had been successively occupied. To begin with, it is a suitable place for the rallying of the savage tribe; after that of the semi-civilised and settled community with their religious ceremonies, or a parish meeting, and possibly a stockade; then, perhaps, the Roman villa of the Commander, and after that first the Saxon and then the English church, or the mediæval castle. In the time of the Saxons the Downs must have been much of a waste, except that their lonely valleys gradually accumulated a house and a barn or two. Before that time they were, probably, more covered with wood. The iron axe was more potent in clearing than the flint, or even the bronze. Within living memory there had been a decrease in trees, but some of the old hawthorns, such as those at the base of Cissbury, seemed likely to live for ever. When we got down to mediæval times the Downs were still interesting,—the, perhaps, greatest event in English history took place on the Downs, the Battle of Lewes in 1264, and it was only about a week ago according to the day of the month! The escape of Charles II. took place over the Downs.

The exceedingly isolated valleys and parishes of the Downs led to an almost peculiar language and manner. Many persons never left the place where they were born the whole of their lives, and most people in the parish were related to each other; and they had many local superstitions. There were other marks on the Downs of green rings—called fairy rings. These were quite recently attributed to the night dancing of Fairies, but were now well-known to be caused by fungi. The Fairy, or Pharisee, as he was called, was quite a belief. There was a story that a certain farmer found every morning that some of his corn had been thrashed out, and going to the barn saw a lot of little fairies thrashing it out, one saying to the other, “Do you twet—I twet?” Not approving of this proceeding, he frightened them away, after which he withered and died for his ingratitude! The belief in witchcraft was almost universal in these lonely villages. A story was told him once of a woman who was supposed to be a witch, and she was attacked and escaped from her house in the form of a hare. One of the men set his dog at her, it seized her, but she escaped, but when next seen at home she had a wound where the dog bit her. This was told him in all seriousness.

The nomenclature of the Downs was all ancient; the coombis, from the British *cwin*; the Denes, Saxon; the holts and copses, ancient forms of language. Near Lewes was Oxsettle Bottom, which a friend assured him was derived from early British—the “upper shooting valley”—pointing out the curious fact and coincidence that it was a rifle range. But he was afraid

he could not enforce this, as the "ox-settle," or "ox-shelter," or its remains, were found not long ago. A neighbouring valley was called Bible Bottom, from an ancient (?) cattle enclosure in the valley. It had been ploughed over within the last fifty years, and the farmer earned great obloquy for having ploughed up the bible.

The closing passages of Mr. Jenner's paper were devoted to the Downs of modern times, and the speaker dwelt upon their beautiful contour, their never failing variety, and their health giving air. Very few artists had succeeded in representing them accurately. Their native animals were few—the fox, the hare, the rabbit, and a few small animals such as the stoat. Birds were numerous in the wooded portions. In no part could the nightingale be heard so well, while the cuckoo rejoiced in the wooded valleys. The wheatear, which was formerly considered a luxury, still occurred, though it was caught by thousands by the old-time shepherd; and anyone reclining on the soft turf could not help exclaiming, "Hark, the lark at heaven's gate sings." The Great Bustard formerly occurred near Lewes, and he knew a man who had seen them; and the stone curlew, he hoped, still occurred on Kingston Hill. There were still many lovely haunts of birds where, with a good field glass, one could watch the birds at leisure. Many of the rarest of migratory birds had chosen to alight on the Downs after their cross-sea passage. The neighbourhood of Black Rock used to be famous for arriving migrants, and the late Mr. Monk obtained many of his birds—the collection of which had just been secured by Brighton—from that locality. Among them was a "Richards pipit," and he well remembered Mr. Monk shewing him a telegram worded: "If you wish to see A Richards alive come at once," which caused him consternation and bewilderment.

In the hangers and copses, especially on the northern slopes, many good snails might be taken. He named some of the varieties, as also shells to be found on the southern slopes of the Downs near Lewes. In the autumn, two species were in great profusion. As to butterflies, they had on the South Downs the largest number that occurred in any British locality—clouded yellows, the painted lady, and an army of blues. A colony of the marbled white *M. galathea* resided near Firle Beacon. Many rare moths were also to be found, and other rare insects could be taken on the short turf at night by means of a lantern, though the experience of searching was a weird one. The loneliness and solitude of parts of the Downs was, indeed, quite striking, even in the daytime, but at night it was remarkable. There seemed to be some influence of late, he knew not what, that had lessened the number of good insects, though perhaps the farmer would tell them that it had not lessened the wireworm or the aphid.

Passing on to the plants of the Downs, he felt that their friend, Mr. Hilton, could say more than he could on that subject. One could, at any time, count at least twenty species of plants in a square yard. Yet, though dwarfed, like Japanese trees, everyone was perfect. On the steep slopes, especially to the north, there was wood, less in East than in West Sussex, mainly composed of beech,—in places ash. Among these beechen groves, which at this time of the year afforded the most splendid greenery of which the country could boast, occurred some of our rarest orchids. In June the hills were yellow with furze bloom, and later they were purple with thyme. Near Seaford could be found *Seseli libanotis*, in a small colony which must have entered England by a spur of Downs which formerly joined France. He had not time to say more on natural history. During the Napoleonic wars a great portion of the Downs was converted into arable land, but latterly a good deal had been allowed to go back, owing, he supposed, to the decreased price of wheat. But one still saw the staple industry of the Downs, the Southdown sheep, unequalled in the world, with sometimes the old-time sheep dog, and the old-time shepherd, who, if he had time to spare,—and usually he had plenty,—could tell many a yarn while his dog was investigating one's legs, and the "*golfus vulgaris*" was crying "fore." Among the disappearing features of the Downs were those famous landmarks the windmills, and another feature—not quite gone, but going slowly—the employment of oxen for ploughing and carting. There was much more he could say if time permitted. He had attempted to be suggestive, not instructive. He could not instruct in all these matters, but he wanted to lead others to investigate them, and think them out for themselves. It not only added to the pleasure of a walk but added scientific knowledge, and, in spite of motors, there was no better way of studying Nature than walking. In conclusion, he trusted they would still be able to sing, "Oh who will o'er the Downs so free," in spite of bridle paths and barbed wire. He hoped he had not wearied them, but these studies had been the pleasure of his life. Also he felt with Rudyard Kipling :

" Each to his choice, and I rejoice
 The lot has fallen to me
 In a fair ground—in a fair ground—
 Yea, Sussex by the sea ! "

WEDNESDAY, JUNE 14TH, 1905.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 14TH, 1905.

In entering on the 51st year of its existence, some change in the conduct of the Society's affairs had to be made. On the resignation of Mr. E. Alloway Pankhurst, who, besides having been President for the two previous years, had for many years discharged, in a most efficient manner, the duties of Scientific Secretary, the Society decided upon the appointment of a Sub - Committee, consisting of the President and Secretary (*ex-officio*), Mr. Caush (past President), Dr. Harrison, and Mr. Hora, to carry on the detail work in connection with lectures, &c.

Changes in the Membership of the Society have been numerous. We have to mourn the loss, by death, of four Members, all of whom were exceedingly well known to the older residents of Brighton and neighbourhood, viz.: Mr. Henry Willett, an original founder of the Society, who interested himself not only in this, but in all other Literary, Artistic, and Philanthropic Societies of the town; Dr. Badcock, a much respected medical practitioner; Mr. Henry Mathews, a distinguished classical and Oriental scholar, and for sixteen years Chairman of the Brighton Library; and Mr. W. Mitchell, a very old Member and regular attendant at the Society's lectures, who, at the time of his death, held the post of Honorary Librarian. Seven other Members have resigned, whilst ten new Members have been elected.

During the winter months the President inaugurated a series of afternoon and evening visits to factories, Municipal works, and other places of local interest. These visits became exceedingly popular and were largely attended, and the Society is greatly indebted to its President, at whose initiative and by whose tireless energy almost the entire work in connection with them has been carried out.

All Members are cordially invited to co-operate in the work of the Society, and to extend its sphere of usefulness : (1) By regular attendance at its meetings ; (2) By persuading any local friends interested in Natural History, Physical Science, &c., to become Members ; (3) By enlisting the services of experienced lecturers and science enthusiasts for papers and practical work.

The following is a list of papers contributed at the Society's meetings during the Session :—

- 20th Oct., 1904.** "The Functions of Music"—
The PRESIDENT, Mr. HENRY DAVEY.
- 17th Nov., 1904.** "Half a Day on the Seashore"
(with lantern slides)—
Mr. ED. CONNOLD, F.E.S.
- 15th Dec., 1904.** "Evening with the Microscope"—
Under the direction of
Mr. D. CAUSH, L.D.S.
- 13th Jan., 1905.** "Social Evolution and Public Health"—
Dr. A. NEWSHOLME, F.R.C.P.
- 17th Feb., 1905.** "A Peep at Prehistoric Man"
(with lantern slides)—
Mr. C. ROBBINS, L.D.S.
- 17th Feb., 1905.** "Weather during January, 1905"—
Dr. W. J. TREUTLER, M.D., F.L.S.
- 25th Feb., 1905.** "The 'Booth' and 'Monk' Bird Collections" (at the Booth Museum)—
Mr. ARTHUR GRIFFITH, M.A.
- 16th Mar., 1905.** "The Evolution of Artillery"—
Colonel E. KENSINGTON, (late) R.A.
- 24th Mar., 1905.** "A Tour in Spain" (with lantern slides)—
Mr. E. PAYNE, M.A.
- 28th April, 1905.** "The History of the Skull"
(with lantern slides)—
Mr. J. THORNTON CARTER, M.R.C.S., L.R.C.P.
- 18th May, 1905.** "History of the Southdowns"
(with lantern slides)—
Mr. J. H. A. JENNER, F.E.S.

The following is a list of Excursions and Visits to Works since the last Annual Meeting :—

22nd June, 1904.	St. Leonard's Forest.
6th July, 1904.	Chanctonbury Ring.
17th Sept., 1904.	"Long Man," Wilmington, and Alfriston.
1st Oct., 1904.	Gas Works and Electric Light Works, Portslade.
9th Nov., 1904.	Hove Gasometer.
10th Dec., 1904.	Abattoir and Dust Destructor.
27th Jan., 1905.	Corporation Electricity Works.
25th Feb., 1905.	Booth Museum.
25th Mar., 1905.	Borough Sanatorium.
8th April, 1905.	The Dyke and Bramber.
29th April, 1905.	Ditchling Beacon.
13th May, 1905.	Hassocks.
27th May, 1905.	Tilgate Forest.

It is gratifying to state that the average attendance at the lectures has been considerably increased during the Session.

LIBRARIAN'S REPORT, JUNE 14th, 1905.

With the valuable help of the late Mr. H. J. Mathews, M.A., a new Catalogue has been prepared, and may be seen in a special drawer in the Reference Library.

The purchase of the "Challenger" Reports has been resumed, and will be continued until completed.

The alteration in the new Municipal building has enabled the Society's Library to be fully visible to the public, and it is now largely used for reference purposes.

I regret to mention that not very many of these valuable Books and Periodicals have been lent out to the Members of the Society this last year.

The Bookcases have been re-fitted with New Locks.

ROBERT MORSE,
Hon. Librarian.

METEOROLOGY OF BRIGHTON.

Month.	TEMPERATURE OF AIR DURING MONTH.			WIND.			RAINFALL.			SUNSHINE.		
				Number of Days of			Amount collected in Inches.			Number of Sunless Days.		
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Rain fall.	Hour recorded.	
July,	64.1	61.8	62.8	62.1	42.1	46.1	44.3	44.1	46.1	51.0	283.40	
August,	62.1	62.1	62.1	62.1	42.1	46.1	44.3	44.1	46.1	51.0	244.96	
September,	58.1	58.4	58.4	58.1	42.1	46.1	44.1	44.1	46.1	51.0	249.26	
October,	54.9	54.9	54.9	54.9	42.1	46.1	44.1	44.1	46.1	51.0	205.06	
November,	51.9	51.9	51.9	51.9	42.1	46.1	44.1	44.1	46.1	51.0	182.50	
December,	44.8	44.8	44.8	44.8	32.9	35.9	35.9	35.9	35.9	51.0	163.35	
January,	39.9	39.9	39.9	39.9	29.1	32.5	32.5	32.5	32.5	51.0	101.83	
February,	35.9	35.9	35.9	35.9	29.1	32.5	32.5	32.5	32.5	51.0	82.15	
March,	32.3	32.3	32.3	32.3	22.1	22.1	22.1	22.1	22.1	51.0	109.02	
April,	29.0	29.0	29.0	29.0	12.0	12.0	12.0	12.0	12.0	51.0	68.30	
May,	25.0	25.0	25.0	25.0	5.0	5.0	5.0	5.0	5.0	51.0	40.42	
June,	21.0	21.0	21.0	21.0	0.0	0.0	0.0	0.0	0.0	51.0	46.83	
July,	17.0	17.0	17.0	17.0	0.0	0.0	0.0	0.0	0.0	51.0	75.50	
August,	13.0	13.0	13.0	13.0	0.0	0.0	0.0	0.0	0.0	51.0	86.31	
September,	9.0	9.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0	51.0	147.28	
October,	5.0	5.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	51.0	82.56	
November,	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	51.0	131.02	
December,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	118.35	
January,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	165.50	
February,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	283.25	
March,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	215.38	
April,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	175.92	
May,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	200.48	
June,	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.0	1836.26	
Entire Year	82.6	82.6	82.6	82.6	22.1	51.3	85	85	85	22.1	54	
Average of Years 1877-1894...	..	..	..	..	..	50.4	..	..	..	..	67	1592.00

Brighton and Hove Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 14TH JUNE, 1905.

HERBARIUM, 1904.

The following plants were added to the Herbarium this year, with others :—

<i>Stachys ambigua.</i>	Henfield.
<i>Sagina reuteri.</i>	Portslade.
<i>Quercus intermedia.</i>	Plumpton.
<i>Myosotis sylvatica.</i>	Frant.
<i>Festuca myuros.</i>	Barnham.
<i>Hieracium murorum, var. pellucidum.</i>	Withdean.
<i>Hieracium sciophilum.</i>	Chalk-mounds, Pangdean.
<i>Bromus interruptus (Druce).</i>	Rottingdean.

The first report of it in Sussex.

<i>Bromus brachystachys.</i>	Rottingdean.
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The first report in Sussex.

<i>Eruca sativa.</i>	Racehill, Brighton.
<i>Vicia villosa.</i>	Henfield.
<i>Potentilla Norvegica.</i>	Hove.
<i>Salsola kali, var. tenuifolia.</i>	Kingston-by-Sea.

I think native there, if so, a new plant in the British Flora.

A *Silene* found wild on the Downs in several places not far from Brighton and in some other place in England, has, after much dispute among botanists, been determined by Mr. C. E. Salmon, F.L.S., to be *Silene dubia*, Nerbich—*S. Nutans*, var. *dubia*. It is therefore new not only to Sussex, but to Britain. A specimen was added to the Society's collection some years since.

T. HILTON,
Curator.

RESOLUTIONS, &c., PASSED AT THE 51st ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

"That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Report as to the Library, and the Curator's Report, be received, adopted, and printed for circulation, as usual."

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

"J. E. Haselwood, E. J. Petitfour, B.A., F.C.P., F. Merrifield, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., J. P. Slingsby Roberts, W. Clarkson Wallis, and E. Alloway Pankhurst."

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

"Mr. J. W. Nias and Mr. A. F. Graves."

It was proposed by Mr. SLINGSBY ROBERTS, seconded by Mr. CLARKSON WALLIS, and resolved—

"That the following gentlemen be Officers of the Society for the ensuing year :—*President*, Henry Davey; *Ordinary Members of Council*: J. H. A. Jenner, S. R. Penney, J. Sussex Hall, F. R. Richardson, E. Payne, M.A., and Alfred W. Oke, B.A., LL.M.; *Honorary Treasurer*: E. A. T. Breed; *Honorary Librarian*: Robert Morse; *Honorary Curators*: H. S. Toms and T. Hilton; *Honorary Scientific Secretaries*: D. E. Caush, L.D.S., W. Harrison, D.M.D., and F. R. Hora, B.Sc., B.A.; *Honorary Secretary*: J. Colbatch Clark, 9, Marlborough Place; *Assistant Honorary Secretary*: H. Cane."

It was proposed by Mr. D. E. CAUSH, seconded by Mr. COLBATCH CLARK, and resolved—

"That the best thanks of the Society be given to Mr. Henry Davey for his attention to the interests of the Society as President during the past year."

It was proposed by Mr H. W. CHARRINGTON, seconded by Mr. I. WELLS, and resolved—

“That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curators, the Honorary Auditors, and the Honorary Secretaries for their services during the past year.”

It was proposed by Dr. W. HARRISON, seconded by Mr. T. HILTON, and carried—

“That the following New Rule be substituted for Rule 12 of the Society, viz.:—‘12. Every Gentleman elected an Ordinary Member shall pay an Entrance Fee of 10s, and both Ladies and Gentlemen elected as Ordinary Members shall each pay an Annual Subscription of 10s. *Except that a Member Elected between the 1st February and the 1st April in any year, shall pay a subscription of 5s. only for that year.* Such subscription shall be payable in advance, and the first payment shall date from the 1st of October preceding the Election, except the Election take place from the 1st of April to the 30th September, both inclusive, when it shall date as on 1st of the October following.

• The words in italics constitute the alteration from the then existing Rule.' ”

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society.

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society, The Museum, College Square, N. Belfast.

Boston Society of Natural Science (Mass, U.S.A.).

British Museum, General Library, Cromwell Road, London, S.W.
British and American Archæological Society, Rome.

Cardiff Naturalists' Society, Frederick Street, Cardiff.

City of London Natural History Society.

Chester Society of Natural Science.

- Croydon Microscopical and Natural History Club, Public Hall,
Croydon.
- City of London College of Science Society, White Street,
Moorfields, E.C., and "Hatfield," Tenham Avenue,
Streatham Hill, S.W.
- Department of the Interior, Washington, U.S.A.
- Edinburgh Geological Society, India Buildings, George IV.
Bridge.
- Eastbourne Natural History Society.
- Epping Forest and County of Essex Naturalist Field Club, West
Ham Institute.
- Folkestone Natural History Society
- Geologists' Association.
- Geological Society of Mexico.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- London County Council, Horniman Museum.
- Leeds Naturalist Club.
- Lloyd Library, 224, West Court Street, Cincinnati, Ohio, U.S.A.
- Lewes and East Sussex Natural History Society.
- Maidstone and Mid-Kent Natural History Society.
- Mexican Geological Institute, 5A, Del Cipres, No. 2,728 Mexico.
- North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells
Bladen, Secretary).
- Nottingham Naturalists' Society, University College, Nottingham.
- Peabody Academy of Science, Salem, Mass., U.S.A.
- Quekett Microscopical Club, 20, Hanover Square, London, W.
- Royal Microscopical Society, 20, Hanover Square, London, W.
- Royal Meteorological Society, Prince's Mansions, 73, Victoria
Street, S.W.
- Royal Society, Burlington House, Piccadilly.
- Smithsonian Institute, Washington, U.S.A.
- South-Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Southport Society of Natural Science, Rockley House, Southport.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- University of Colorado, Boulder, Colorado.
- Watford Natural History Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton and Hove Natural History and Philosophical Society,

1905.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton.

ORDINARY MEMBERS.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.

ASHTON, C. S., 10, Powis Grove.

ATTREE, G. F., 8, Hanover Crescent.

BILLING, T., 6, St. Michael's Place.

BOOTH, E., 53, Old Steine.

BREED, E. A. T., 13, Buckingham Place.

BULL, W., 75, St. Aubyn's, Hove.

BURROWS, W. S., B.A., M.R.C.S., 62, Old Steine.

BURCHELL, E., M.R.C.S., L.R.C.P., 5, Waterloo Place.

BEVIS, F. J., 28, Florence Road.

CANE, H., 173, Ditchling Road.

CATT, REGINALD J., 22, Wolstonbury Road, Hove.

CAUSH, D. E., L.D.S., 63, Grand Parade.

CHARRINGTON, H. W., 23, Park Crescent.

CLARK, J. COLBATCH, J.P., 9, Marlborough Place.

COLMAN, Alderman J., J.P., Wick Hall, Furze Hill.

CLIFTON, HARVEY, 19, Buckingham Place.

DAVEY, HENRY, 15, Victoria Road.

DENMAN, S., 26, Queen's Road.

DODD, A. H., M.R.C.S., L.R.C.P., 49, Church Road, Hove

DRAPER, C. H., D.Sc., B.A., Municipal School of Technology.

EWART, Sir J., M.D., F.R.C.P., M.R.C.S., F.Z.S., Bewcastle,
Dyke Road.

ELLIOTT, J. H., L.D.S., 45, Stanford Road.

FLETCHER W. H. B., J.P., Bersted Lodge, Bognor.

FAWSITT, CHATER H. G., 14, Vernon Terrace.

GILKES, J. H., Wychcote, Dyke Road Avenue.

GRAVES, A. F., 9A, North Street Quadrant.

GRIFFITH, A. F., M.A., 59, Montpelier Road.

GROVE, E., Norlington, Harrington Road.

GRINSTEAD, J., 13, Powis Square.

HALL, J. SUSSEX, 69, Ship Street.

HACK, D., Fircroft, Withdean.

HARRISON, W., D.M.D., L.D.S., 6, Brunswick Place, Hove.

HASELWOOD, J. E., 3, Richmond Terrace.

HAYNES, J. L., 24, Park Crescent.

HENRIQUES, A. G., F.G.S., J.P., 9, Adelaide Crescent, Hove

HICKLEY, G., 92, Springfield Road.

HILTON, T., 16, Kensington Place.

HOBBS, J., 62, North Street.

HORHOUSE, E., M.D., F.R.C.P., 12, Second Avenue, Hove.

HOWLETT, J. W., J.P., 4, Brunswick Place, Hove.

HORA, F. R., B.Sc., B.A., A.R.C.Sc., 32, Norton Road, Hove.

HARRISON, F., M.A., 30, Compton Avenue.

INFIELD, H. J., Sylvan Lodge, Upper Lewes Road.

JACOMB, Wykeham, 72, Dyke Road.

JENNER, J. H. A., 209, School Hill, Lewes.

JENNINGS, A. O., LL.B., 11, Adelaide Crescent, Hove.

JOHNSTON, J., 12, Bond Street.

KNIGHT, J. J., 33, Duke Street.

LANGTON, H., M.R.C.S., 11, Marlborough Place.

LAW, J., Crosthwaite, Lewes.

LEWIS, J., C.E., F.S.A., Fairholme, Maresfield.

LOADER, KENNETH, 5, Richmond Terrace.

LONSDALE, L., 13, Powis Square.

MCKELLAR, E., Deputy-Surgeon-General, M.D., J.P., Woodleigh,
Preston.

MAGUIRE, E. C., M.D., 9, Old Steine.

MAY, F. J. C., 25, Compton Avenue.

MERRIFIELD, F., 24, Vernon Terrace.

MILLS, J., 24, North Road.

MORGAN, G., L.R.C.P., F.R.C.S., 6, Pavilion Parade.

MANSFIELD, H., 11, Grand Avenue, Hove.
 MINTO, J., M.A., Public Library.
 MORSE, ROBERT, 26, Stanford Avenue.
 MAURICE, H., L.D.S., 65, St. John's Terrace.

NEWMARCH, Major-General, 6, Norfolk Terrace.
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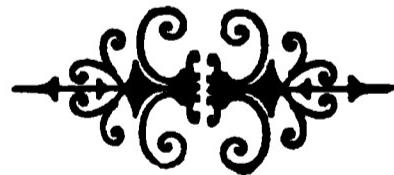
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Natural History and Philosophical
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THURSDAY, OCTOBER 26TH, 1905.

Sponges.

BY

MR. E. CONNOLD.

AT the opening meeting, the difficult subject of "Sponges" was discussed in a masterly way by Mr. E. Connold, of Hastings. The question as to whether the flint nodules so commonly met with in chalk strata are or are not due to deposits of silicious sponges was among the points dealt with. The exceptionally fine collection of sponges in the Brighton Museum makes the subject specially interesting to local scientists, as the President remarked when introducing Mr. Connold.

THURSDAY, NOVEMBER 16TH, 1905.

Philosophy of Dress.

BY

DR. A. WILLIAMS, M.D.

"**T**HE Philosophy of Dress" was the somewhat novel subject discoursed upon by Dr. A. Williams, M.D. The lecturer opened with a brief physiological explanation of the heat regula-

tion of the living body and of the evolution of dress. Then, illustrating his remarks by drawings on the blackboard and enlivening them with numerous anecdotes, Dr. Williams said:—

Clothing serves man as a means of protection, and for æsthetic purposes.

The following properties should be studied in clothing materials, from a health standpoint :—

- (1) Conduction of heat.
- (2) Power of stimulating or irritating skin.
- (3) Power of absorbing moisture, and porosity to air.
- (4) Power of absorbing light and heat rays.

Heat Conduction.—Some substances, when brought in contact with a heated body, rapidly remove its heat and conduct it along their substance. They are called good conductors. Excepting under conditions of great external heat, good conductors when touched by our bodies feel cold: they remove body heat. Linen is a better conductor than wool; and if on a cold winter's night one turns in between linen sheets the bed feels far colder than it would if the sheets were taken away and wool blankets brought in contact with the skin. Bad conductors of heat are therefore warm clothing materials.

Gases are bad heat conductors; yet, if the body were exposed unclothed to the atmosphere it would be rapidly chilled. This is the result of *convection currents*. The air in immediate contact with the body is warmed; it expands and rises, and cold currents of air flow down and take its place. This process continues, and large amounts of heat removed. If convection currents are stopped, air may be made a valuable clothing material. Thus the layers of air between bedclothes form a warm clothing: the bedclothes prevent convection currents. Two thin garments are warmer than a single thick one: there is a layer of imprisoned air between them. Loosely-woven fabrics are warmer than closely-woven ones: air fills the space between the fibres, and friction *plus* attraction stops the convection currents.

The power of heat conduction of a clothing material depends upon (1) the substance of which it is composed, and (2) the way it is woven; loosely-woven materials being worse conductors of heat.

ORDER OF HEAT-CONDUCTING POWER OF DIFFERENT FIBRES.

Linen	=	Best conductor	=	Cold clothing.
Cotton	=	Good conductor	=	Cool clothing.
Silk	=	Fairly bad conductor	=	Warm clothing.
Wool	=	Worst conductor	=	Very warm clothing.

Furs, and skins generally, feathers and down, are also bad conductors.

Skin Stimulation.—The property is usually objectionable in underclothing. The degree of trouble depends upon the sensitiveness of the individual, and upon the clothing material. The same material may in one individual cause a pleasant stimulation, and in another maddening irritation. The sense of warmth produced by skin stimulation is deceptive. It is due to dilation of surface vessels.

Wool is very stimulating, especially coarse wools; silk is much less so, but much depends on its preparation. Cotton is very slightly stimulating, and flax even less so. Fabrics made with very loose projecting fibres are less stimulating than those with fluffy surfaces. Some poisonous dyes injuriously irritate skin.

Water Absorption.—It is important that underclothing should readily absorb moisture, and pass it through its substance. In this way secretions of skin are not interfered with; evaporation takes place from surface of clothing instead of skin, and too rapid chilling is prevented. Overclothing for protection is better for having less power of absorption. Rain, etc., does not soak and make the clothing wet and heavy; and, moreover, air driven by wind will not so easily penetrate, and so such garments better protect body from external cold. Power of absorbing water is greater in loosely-woven fabrics.

Different fibres vary in their individual power.

Wool readily absorbs moisture.

Silk is less freely absorbent.

Linen absorbs moisture with difficulty.

Cotton fibres absorb badly, and are easily wetted.

Absorption of light and heat rays.—Dark-coloured materials absorb heat and light, and turn light rays into heat easily. So dark overclothing is hot in summer time.

Dark clothing absorbs and retains smells more than light-coloured clothing.

Clothing and garments should be arranged so as to avoid the following defects :—

- (1) Interference with free passing away of skin secretions.
- (2) Injurious action by friction or pressure.
- (3) Interference with natural movements of body.
- (4) Upset of heat-regulating power by excessive clothing.
- (5) Irregular clothing.

These defects can be well appreciated by studying some common forms of clothing.

Underclothing.—Flannel forms the best material for underclothing. In some cases flannel irritates the skin, and cannot be worn without great discomfort; merino may be tolerated in such cases. If merino also is too irritating, then, as pure silk is too expensive a material for the majority of us to wear, we must choose between flax and cotton. Both cotton and flax, in the form of closely-woven materials, as calico and linen, are cold things to wear, and they do not allow the sweat to pass readily away through them, and so are unsuitable for underclothing. A very good material for this purpose can, however, be made from cotton. This is done by weaving the cotton in a loose cellular manner, so as to leave air spaces between the fibres, a good cheap example of such material is sold under the name of oatmeal cloth or canvas cloth. This conducts heat slowly from the skin, and absorbs moisture fairly well and does not irritate the skin.

At night underclothing of healthy people should be made of smooth calico or linen. Woollen underclothing is in some cases a cause of restless nights. At night a healthy person does not, or ought not to sweat much. Night sweating indicates too much clothing or disease.

Patients troubled with chest complaints or rheumatism may require to wear flannel or oatmeal cloth night-dresses, especially if they sweat much at night.

Overcoats and outside clothing for cold windy weather should be made of material through which the wind does not easily blow. Woollen goods, as a rule, are easily blown through; cotton is less porous to the wind. Wool cloth overcoat, lined with smooth stout cotton, is often worn, but as a warm covering against cold winds it should be worn with the cotton outside. Mackintosh is impervious to the wind, but is bad to wear when we are walking or doing much exercise, as it keeps the sweat moisture from passing out. For driving in cold winds mackintosh forms one of the best overclothing.

It is a mistake to wear too much clothing. The over-loading, over-coddling of the body with a lot of clothing destroys the natural powers possessed by the body of resisting cold, and the least exposure is followed by ill-results. Some parts of the body that are liable to be exposed to accidental chill and cold—for example, the feet—should be trained by a judicious hardening process to withstand such exposure. Many people, even with good sound organs of circulation, suffer from cold feet, and even slight exposure with wet feet results in a bad cold. The feet habitually swaddled up in wool and leather get tender, the natural protection against cold (partly a muscular mechanism) wastes away from disuse, and becomes useless in times of exposure. Healthy people need not catch cold from wet feet any more than from wet hands. The train-

ing must be like all training, gradual and regular. The author has succeeded in curing himself and several other patients suffering from cold feet by the following method :—Begin treatment in summer time. Summon up sufficient courage to overcome domestic opposition (especially necessary for married men), and habitually forget to put on shoes and socks until after breakfast. After a while extend the training to a good tramp on dry turf ; later on walk barefooted on the dewy grass in early morning. Continue this regularly, and when the winter comes complete the training by walking for a short spell barefooted on the hoar frost or snow-covered grass. Then cold feet during railway journeys, chilblained feet, and coughs and colds from wet feet will be things of the past, providing that the training be kept up at intervals, and that tight foot clothing be always avoided. Of course, such a course of training is only suitable for those under middle age.

Head Clothing.—Avoid heavy head-dress. If a hat with rigid brim is worn it ought to be made to measure. Hats should be ventilated—*i.e.* with proper inlet and outlets. The head should be kept uncovered as much as possible.

Neck Clothing.—The neck should be either always exposed without any clothing, or else always wrapped up. The habit of occasionally wearing mufflers, etc., at one time and then going without at another, or of generally wearing a high-necked dress and then occasionally a low-necked one, often cause throat and chest troubles. Mufflers, boas, etc., if never worn, are never required. When clothing is worn round the neck it must always be loose. Tight neck clothing is especially dangerous for stout people after middle life : it may favour apoplectic fits. Tight night-dresses are especially dangerous.

The *clothing of the chest* ought to be loose, especially during exercise, when amount of respiration is greater.

Corsets and Stays.—Young girls should never wear stays, they are only injurious, and lead to a non-development of the natural support of the body, and render the wearing of artificial supports in after-life necessary. Old stout people sometimes require stays, and these should be of some firm material, such as stout jean without bones. All pressure round the waist is injurious to health.

Garters tightly constricting the thigh above, or the leg below the knee, must not be worn. Anyone who suffers or has any relations suffering in any way with enlarged or varicose veins, must be most careful to avoid garters. Suspenders are better than garters, but these may, with advantage, be done away with if our legs are well developed by exercise, so that the calf will keep the stocking in its place.

Trousers are, as a rule, better than knickerbockers, as with

garters anyone with a tendency in the family to the formation of varicose (swollen and knotted) veins, had better avoid altogether the wearing of knickerbockers. In such cases cyclists had better wear the old-fashioned peg-top trousers.

The bad effects of knickers are accentuated by the sitting posture with the legs bent at the knees.

Socks are better than stockings for the above reasons. The socks ought not to be worn with pointed toes. The toe should be more square-shaped or slightly slanted off towards the outer side.

Boots ought to be made to fit the foot. The measurement of the sole should be taken when standing up with the foot firmly implanted on the ground. This can be done by making a tracing of the outline of the foot on paper. Pointed-toed, high-heeled, and tight boots are the principal causes of corns, bunions, and disabling deformities of the foot. The sole ought to be as flexible as possible, the heel far back, and never more than $\frac{3}{4}$ in. high. Lace-up boots are better than elastic sides, especially for those who have a family history of varicose veins.

Beds and Bedding.—Metal bedsteads are better than wood. Curtain hangings round the bed are bad. Bedsteads should be easily moved, and so ought to have good castors. The entire floor of a bedroom should be cleaned thoroughly at least once a week ; this cleaning must include the space under the bed ; for this and other reasons the bed must not be made, as it often is, a cover for the lumber of the household.

Spring mattresses of twisted uncovered wires, are by far the best kind for health. On this spring base a good thin horse-hair mattress should be placed, and, if preferred, there is no great objection to placing over this a feather bed. Patients liable to asthma cannot always stand feather beds and pillows. Feathers give out a little fine dust, not enough to do harm to healthy tissues, but enough to cause asthma in some susceptible persons, and to do harm sometimes to people who, in consequence of obstruction of the nose, sleep with their mouths open. Air pillows or good horsehair stuffed pillows are the best substitute for feathers in these cases.

The covering bedclothes should not be heavier than is absolutely necessary for proper warmth. Bedclothes must be properly aired. When we get up in the morning the bedclothes should be taken off, one by one, and spread out, so that fresh air can circulate through them, and they should be left spread out in this way in fine weather, with the window wide open, for at least two hours. The idea that airing the beds consists in sleeping in them is absurd. Sleeping in the bed merely uses up the good air in the bed, and passes into its place damp foul gases from the skins of those sleeping in them. Colds and

various lung, skin, and infectious diseases are frequently spread by bedclothes.

Clothing for Babies.—A little dusting powder is required next the skin. A flannel binder round the abdomen should be worn. It must never be bound tightly, but ought to be merely wrapped gently round the waist. A shirt of fine lawn may be worn and then a good flannel gown over all. Should any further clothing be required, a good worsted or flannel shawl forms one of the best garments. An infant's clothing must not be tight anywhere. Serious mistakes are continually made by having tight sleeves and tight strings round the neck and waist.

Young children are more liable to damage from deficient clothing than adults. There are two great reasons for this, first, children have a relatively larger surface to be chilled ; second, inefficient clothing necessitates using up of food to produce warmth instead of promoting growth and development. The full growth and development of body and, to a less degree, of mind, are checked by deficient clothing. In after-life this check may never be made up. It is equally bad to put excess of clothing on a child. In this case development of heat-regulating power is weakened and child becomes liable to chills, etc. The over-swaddled child cannot take proper exercise, and this checks development. Contrary to many authorities the author believes in training young children to do without stockings and boots or shoes. Short trousers coming nearly down to the ankles and sandals are far better clothing for young children.

THURSDAY, DECEMBER 7TH, 1905.

Photo-Micrography.

BY

DR. E. SPITTA, M.D., F.R.M.Soc.

Illustrated with Lantern Slides.

THIE marvels of the infinitely small are as wonderful as the marvels of the infinitely great." The statement was made to the members by Dr. E. Spitta when lecturing on the subject of "photo-micrography," and he easily proved his point. Dr. Spitta is a scientist who has won distinction in regions of which few of us are conscious by reason of the fact that we cannot see them.

Dr. Spitta revels in things which are too small to be seen by the naked eye, so small that the point of a needle would make a fine platform for the concourse of an army of them, and now, with the aid of amazing photographs which he has taken by the process of photo-micrography, he was able to lead his audience with him to explore the wonders of the infinitely small.

To magnify a thing by a thousand diameters was nothing to Dr. Spitta; when he had done that he had only got his object ready to begin the real work of magnifying it. He showed a photograph of a human hair. The hair was magnified enough to look like a ship's cable, and beside it was a minute object, shaped like a torpedo, which could just be seen. He magnified this further and further till he had it as big as the screen; he magnified it until one could see that it was crossed with myriads of lines, perfectly parallel, perfectly regular,—over six hundred of them could be counted in a space equal to the thickness of a fine hair of the head. Even then he was not content, and he magnified it still further until these parallel lines were found to be composed of dots. In order to see these dots, they had to be magnified by 80,000 diameters,—at which rate an inch would be magnified into a mile and a quarter! So minute is the process that an error in the focussing of one hundredth-thousandth part of an inch would spoil the picture; the vibration caused by a person sneezing in the next room would destroy it.

Among dozens of exceedingly interesting slides that Dr. Spitta threw on the screen was a series showing the wonderful provision of nature for enabling the human body to recover from

disease. He actually had photographs of the germs of diphtheria being attacked by the wonderful protective germs that swarm in the blood. The diphtheria germs are paralysed by one strange organism which bursts among the armies of disease just like a bombshell, and while the germs are thus paralysed the white corpuscles surround them, swallow them, and finally eject their flinty skeletons. It is a daily battle fought out in an arena which a pin's point would destroy.

After showing pictures of the wonderful provisions on the tongues, the antennæ, and other parts of insects, the intricate arrangements which can only be seen when magnified several thousand times, Dr. Spitta was led to exclaim : " How any human being can suppose that these wonderful provisions only ' growed,' like Topsy, without a divine designer to plan such delicate adjustment, is more than I can understand."

THURSDAY, FEBRUARY 1ST, 1906.

Crabs and Lobsters.

BY

REV. THEODORE WOOD, M.A., F.E.S.,

Illustrated with Drawings.

THE subject which Mr Wood chose was "Crabs and Lobsters," and it was quite a new and delightful world of information that he opened out for those who know but little about these creatures of claws and pincers. To the average man, of course, crabs and lobsters are merely toothsome items in a menu, but Mr Wood made it clear that the study of their physical construction and of their habits and ways is fraught with the keenest of interest, even to the point of fascination.

One of the strangest things the members learned was that crabs and lobsters do not grow as we do,—bit by bit every day, but that they grow by fits and starts. When they do grow, their growth is concentrated into a period of about thirty-six hours. It is at these periods that the crab sheds his shell. Mr Wood did not think that crabs and lobsters have any sense of pain as we know it. In illustration of this he told a delightful story about a number of various-sized crabs who were put together in a tank.

When they were first put in they all hid themselves behind the rockery. At length one young crab crept cautiously forth to explore his new surroundings, and no sooner had he done so than a bigger crab pounced upon him, tore him to bits and began to devour him. While the second crab was enjoying his cannibalistic meal, a larger crab still entered the fray and began to chew crab No. 2 with great gusto. And while the third crab was devouring the second, the latter went calmly on with his own dinner.

The audience also learned with a great deal of interest that it is quite impossible for lobsters to suffer from dyspepsia, so finely do they grind their food. The lobster's mouth is placed in his chest, and his food is first ground to pulp by the greater jaws. Then the food is taken in hand by the lesser jaws, but as the lobster is still not satisfied, he turns the food over to a still smaller pair of jaws, known as the "jaw feet." Then the food is passed down to the teeth, which are situated in the lobster's throat and here it is ground to a finer pulp. But still the lobster is not quite happy, for below the teeth is a kind of sieve, and through this the creature strains his food as a last process before it reaches the organs of digestion. The lobster ought to be a highly intellectual animal, for he has no fewer than twenty brains.

Mr. Wood's quaint sense of humour made his lecture all the more entertaining, and it was illustrated by some remarkably clever sketches in coloured chalks done by himself in view of the audience.

THURSDAY, MARCH 1ST, 1906.

Pigeons.

BY

MR. FOXALL.

LUCIDLY dealing with the subject, Mr. Foxall began with an historical outline of Pigeon culture, going so far back as the time of the Egyptians, 2700 B.C. Shewing pictures of the leading varieties, the Lecturer asserted that the present breeds had developed from the blue rock. He instanced the use of carrier pigeons in war, even in ancient times at the siege of Modena, and in 1870 at Paris. In graphic terms he described a year's work in an ordinary Pigeon Loft; indicated how shows should be held and judging carried out; and closed by justifying the Pigeon Breeding hobby as being really a fine art.

THURSDAY, MARCH 15TH, 1906.

Florence.

BY

MR. PAYNE.

MR. PAYNE was a perfect encyclopædia of famous Florentine names—and among them are some of the greatest geniuses in the world's history—and his lucid exposition of the marvels of Florentine architecture, sculpture, frescoes, and paintings, illustrated as they were by excellent photographic lantern slides, was most instructive.

THURSDAY, MAY 17TH, 1906.

Sleep.

BY

DR. A. GRIFFITH, M.A., M.D., D.P.H.

SOME illuminative glimpses into the phenomena of sleep were offered by Dr. A. Griffith, M.A. (Medical Officer of Health for Hove.) The lecture covered a really remarkable range : it was full of thought, eminently suggestive, and had been prepared with such care and regard for detail that it seemed as if not a single aspect of the question had been left untouched. Incidentally the paper revealed Dr. Griffith as a diligent student of Shakespeare ; and he had evidently found much to inspire him in the late F. W. Myers' remarkable book, *Persistence of Human Personality after Death*. Some frequent flashes of dry humour, moreover, helped one to assimilate the purely scientific part of the lecture.

Ordinary sleep, said the Doctor, depends largely on two factors, namely, personal habits and surroundings. There is a wonderful difference in persons, both as to the depth of sleep and to the amount they need. Some persons could even sleep to order,—“their own order, that is,” added the Doctor laconically. To people who suffer from insomnia this must be a very precious faculty. Dr. Griffith counselled, in fact, that the best thing to do

is to learn to sleep whenever you wish to. You never know how useful it may be. The effect of meals upon sleep, he pointed out, is well known. This is aptly seen in animals, who have no business to keep them awake. Here the Doctor paused to protest against the bad habit of taking the heaviest meal of the day four hours before sleep, which comes at the time when the body is becoming energised by the food. Touching upon the pathological phenomena of sleep, Dr. Griffith dealt with the causes of sleeplessness. The sleep of the labouring man is sound, whether he eat much or little: often not all the abundance of the rich will suffer them to sleep. A moderate amount of work, bodily or mental, will produce good sleep, but excess of either will prevent it. Too much mental work, for instance, even if it has not reached the stage when black coffee or a wet towel round one's head is necessary, will cause a restless night. Anxiety, the stimulation of the blood caused by pain, and an excess of physical work, especially of a bustling nature, will act in the same way. The occupation of the mind with one fixed idea is a sure preventive of sleep,—a thing strikingly noticeable in the insane.

Turning to the causes that induce sleep, Dr. Griffith said that these affect the circulation of the blood, or they diminish sensation. Most prominent are various drugs, such as opium, Indian hemp, chloral, bromides, etc., which act partly on the brain and partly on the nerves of sensation. After taking Indian hemp a person imagined himself propelled through eternity and in his flight he saw an elephant magnified to hundreds and thousands of times its natural size. Even beer, added the Doctor slyly, had been known to produce a very drowsy state in some people. A stuffy atmosphere would also induce sleep. The familiar effect of sleep in church is less the result of the sermon than the want of ventilation. Dr. Griffith thought it would be interesting to try the effect of more ventilation in some of our churches as a means of preventing sleep. There are three main ideas, said the Doctor, as to the explanation of the physiological condition of sleep. One idea is that sleep is simply an illustration of the great natural law of rhythm. All earthly things alternate, or are balanced. Thus there are two great forces,—one, gravitation, drawing the earth to the sun; the other, centrifugal force, keeping it to its orbit. Fits and fidgets have their still moments; whooping-cough has its periods of quiet; and even Conservative Governments cease at times. This humorous parallel was much relished by the audience, and helped them to appreciate the lecturer's point that, in accordance with the natural law of rhythm, sleep must come at some time or other. A second theory of the causes of sleep is that it depends on changes in the circulation of the blood, and the consequent effect on the brain, the actual condition during sleep being one of brain bloodlessness. There is

a great deal of evidence, said the Doctor, in favour of this theory, for the disease known as "sleeping sickness" is due to the obstruction of the blood-vessels in the brain, caused by the presence of a worm. A third theory is that sleep is due to simple exhaustion of the nervous system ; and it was to this that Dr. Griffith evidently inclined as being the true cause of sleep. It was an old saying, he observed, that in order to sleep well both brain and body must be tired, and in this he felt there is considerable truth. The brain is the managing director of the whole body. "How is it," he asked, "that a few minutes' good sleep is worth more than hours of rest without sleep ?" This showed that it is the brain which wants rest, which can only be obtained by sleep, for when awake the brain never rests.

The lecturer now somewhat startled his hearers by observing that there is a part of the brain which never sleeps, although, after his explanation, it appeared to be the most natural thing in the world. The brain consists of two parts—the superliminal, or the higher brain, and the subliminal, or the lower brain. When we sleep it is only our higher, conscious self that sleeps ; it is only this conscious self that needs rest. It is the subliminal, or lower brain, that never sleeps. To prove this Dr. Griffith quoted the case of our going to bed at night, making up our minds that we will rise at five o'clock next morning. We get up at five o'clock, but how do we do it ? Have we thought about it all night ? If so, our sleep has not done us much good. The truth is that our faithful other self, our subliminal brain that never sleeps, has come to our rescue and awakened us. It is this subliminal brain that is seen in such an active state in somnambulists. Sleep walkers rarely come to any harm, although they may walk in the most dangerous places ; their safety lies in the automatism of their moments. A particularly interesting part of the lecture dealt with dreams and trances, the power to see visions, and the faculty of holding spiritual communion with departed friends. Here, however, Dr. Griffith was rather stepping beyond the bounds of science, and invading the realm of psychical experience. It was doubtless new to many to learn that animals are dreamers. Dogs, storks, canaries, bullfinches, and eagles all dream, said the lecturer ; but crocodiles are doubtful, he added, amid the laughter of the audience. A great deal in our dreams may have some physical reason. Thus when we dream of a mountain on our chests, that means, the Doctor humorously observed, that we have had lobster for supper ! Again, when our feet become uncovered and get cold we dream that we are walking on ice ! Dr. Griffith closed his lecture with some admirably suggestive thoughts with regard to the psychical aspect of the question, and commended this branch of the subject to the special consideration of the Society.

WEDNESDAY, JUNE 13TH, 1906.

Annual General Meeting.

REPORT OF THE COUNCIL FOR THE YEAR ENDING JUNE 13TH, 1906.

In presenting the Report for the 52nd year of the Society's existence, the Council have pleasure in recording that the attendance has been fairly good at every meeting, and some meetings were very well attended.

There has been a slight decline in Membership, death or resignation having removed 15 Members whilst only 10 new Members have been elected.

The Society has incurred a great loss by the death of two of its leading and most respected Members, viz. : Sir Joseph Ewart, M.D., Past President, and Mr. E. A. T. Breed, for many years its Hon. Treasurer. The Council has filled this last vacancy by the appointment of Mr. Douglas Caush, L.D.S.

Owing to the proposed election of Dr. Walter Harrison, L.D.S., as President, and the resignation of Mr. F. R. Hora as one of the Society's Hon. Secretaries, the Council have proposed the election of Mr. Frederick Harrison, M.A., to the post of Scientific Secretary, to fulfil the duties hitherto discharged by Messrs. Caush, Harrison, and Hora.

During the ensuing Session the Council propose to hold some meetings at Hove.

The following is a list of papers contributed at the Society's meetings during the Session :—

26th Oct., 1905. "Sponges." Lecture by Mr. E. CONNOLD.

16th Nov., 1905. "The Philosophy of Dress."
Lecture by Dr. A. WILLIAMS.

7th Dec., 1905. "Photo-Micrography."
Lecture by Dr. E. SPITTA.

15th Feb., 1906.	"Eclipses of the Sun."	Lecture by Dr. R. J. RYLE.
1st Mar., 1906.	"Pigeons."	Lecture by Mr. G. FOXALL.
15th Mar., 1906.	"Florence."	Lecture by Mr. E. PAYNE.
19th April, 1906.	"Some Curiosities of Plant Fertilization."	Lecture by Mr. H. EDMONDS.
17th May, 1906.	"Sleep."	Lecture by Dr. GRIFFITHS.

The following is a list of Excursions and Visits to Works since the last Annual Meeting :—

24th June, 1905.	St. Leonard's Forest, Colgate Tower.
1st July, 1905.	Ashdown Forest, Wych Cross to Sheffield Park.
5th July, 1905.	Evening Visit: Fry and Co.'s Mineral Water Factory.
8th July, 1905.	Cuckmere Valley, Lullington and Alfriston.
15th July, 1905.	Worthing, Sompting and Lancing.
22nd July, 1905.	Buxted, Hadlow Down and Cross-in-Hand.
2nd Sept., 1905.	West Tarring: Fig Gardens.
21st April, 1906.	Falmer, Ditchling Beacon and Hassocks.
19th May, 1906.	Tilgate Forest.

LIBRARIAN'S REPORT, JUNE 12th, 1906.

The following Serials have been purchased, bound, and added to the Library :—

Nature Notes.	Nature.
Annals of Botany.	Geological Magazine.
Zoologist.	Entomologist.
Entomologist Monthly Magazine.	Journal of Botany.

I have much pleasure in stating that the number of books issued to Members of the Society is this year nearly double that issued last year.

The Society's Library has been largely used for reference purposes by the general public.

ROBERT MORSE,
Hon. Librarian.

METEOROLOGY OF BRIGHTON.

Month.	TEMPERATURE OF AIR DURING MONTH.			WIND.												SUNSHINE from 1890.		
	Highest.	Lowest.	Mean.	Number of Days of						Number of Days of						Number of Hours recorded.		
	N.	N.W.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Rain	Sell.	Amount collected in Inches.	Number of Days on which Rain fell	Number of Sunless Days.				
July,	1905	77.0	64.0	50.8	3	3	3	3	3	2	3	0.44	1	239.14	239.19	195.67	217.89	114.41
,"	1877-1905	85.0	61.9	42.1	2	3	3	3	3	2	3	2.30	1	195.67	217.89	114.41	170.50	125.68
August,	1905	79.6	61.6	45.1	3	3	3	3	3	2	3	2.00	-	1	195.67	217.89	114.41	170.50
,"	1877-1905	80.4	62.1	44.3	1	2	2	2	2	1	2	2.40	5	2	195.67	217.89	114.41	170.50
September,	1905	68.0	57.7	43.7	6	1	2	7	3	4	7	2.55	15	12	114.41	170.50	116.87	63.25
,"	1877-1905	33.2	35.9	58.4	10	10	10	10	10	10	10	2.30	23	16	114.41	170.50	116.87	63.25
October,	1905	59.4	47.1	26.9	8	1	1	3	3	4	7	0.20	9	16	116.87	63.25	88.00	44.50
,"	1877-1905	73.0	51.8	29.5	8	1	1	3	3	4	7	0.68	16	14	116.87	63.25	88.00	44.50
November,	1905	64.4	43.4	28.9	5	5	5	5	5	4	4	0.20	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	63.5	46.2	29.5	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
December,	1905	51.6	42.4	29.5	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	69.4	41.3	25.9	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
January,	1906	50.1	43.4	25.9	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	63.6	47.2	27.1	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
February,	1906	47.9	39.6	27.1	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	58.0	40.9	29.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
March,	1906	52.6	42.9	31.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	65.0	46.7	30.2	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
April,	1906	67.2	47.4	31.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	75.4	47.4	28.9	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
May,	1906	74.2	52.9	35.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	80.8	53.0	40.5	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
June,	1906	72.2	57.2	37.0	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
,"	1877-1905	85.0	59.1	45.0	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
Entire Year	...	79.6	50.1	25.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50
Average of Years 1877-1906 ..	...	79.6	50.1	25.3	6	1	3	1	3	1	7	0.68	14	12	116.87	63.25	88.00	44.50

BRIGHTON & HOVE NATURAL HISTORY & PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 13th June, 1906.

Cr.	Dr.	£ s. d.	£ s. d.
To Balance in the hands of the Treasurer, 14th June,	By Books and Periodicals	...	...
1905	" Bookbinding ...	...	...
" Annual Subscriptions to 1st October, 1905	" Printing Annual Report and Abstract of Proceedings	...	...
" Annual Subscriptions to 1st October, 1906	" " " " "	...	...
" Entrance Fees	" Printing and Stationery (General)	...	...
" Dividends on £100 2½ per cent. Consols for one year	" Postage, &c. (General)	...	...
	" Subscriptions to Societies ...	...	...
	" Clerk's Salary ...	...	...
	" Commission to Collector ...	...	...
	" Expenses of Lectures, Meetings and Excursions, Lantern, Hire of Rooms, Gratuities, Electricity, &c.	...	...
	" Insurance of Books ..	...	...
	" Balance ...	...	...
		£78 17 2	£78 17 2
Balance brought over ... ... ...		... 16 17 3	... 16 17 3

We have examined the foregoing Accounts with the Vouchers and certify the same as correct.

NOTE.—There is a sum of £100 2½ per cent. Consolidated Stock standing in the names of Mr. J. COLBATCH CLARK and Mr. E. A. PANKHURST, as Trustees for the Society.

J. W. NIAS, } Hon.
A. F. GRAVES, } Auditors.

22nd October, 1906.

RESOLUTIONS, &c., PASSED AT THE 52nd ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Report as to the Library, and the Curator's Report, be received, adopted, and printed for circulation, as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“J. E. Haselwood, E. J. Petitfour, B.A., F.C.P., F. Merrifield, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., J. P. Slingsby Roberts, W. Clarkson Wallis, E. Alloway-Pankhurst, and Henry Davey.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. J. W. Nias and Mr. A. F. Graves.”

It was proposed by Mr. H. Cane, seconded by Mr. F. R. Richardson, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year :—*President*: Walter Harrison, D.M.D. ; *Ordinary Members of Council*: F. R. Hora, B.Sc., E. Spitta, F.R.A.Sc., G. Morgan, L.R.C.P., M.R.C.S., F. R. Richardson, E. Payne, M.A., and Alfred W. Oke, B.A., LL.M. ; *Honorary Treasurer*: D. E. Caush ; *Honorary Librarian*: Robert Morse ; *Honorary Curators*: H. S. Toms and T. Hilton ; *Honorary Scientific Secretary*: F. Harrison, M.A. ; *Honorary Secretary*: J. Colbatch Clark, 9, Marlborough Place ; *Assistant Honorary Secretary*: H. Cane.”

It was proposed by Dr. HARRISON, seconded by Mr. F. R. Richardson, and resolved—

“That the best thanks of the Society be given to Mr. Henry Davey for his attention to the interests of the Society as President during the past two years.”

It was proposed by Mr. HENRY DAVEY, seconded by Mr. F. HARRISON, and resolved—

"That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curators, the Honorary Auditors, and the Honorary Secretaries for their services during the past year."

It was proposed by Dr. W. HARRISON, seconded by Mr. H. CANE, and carried—

"That the words 'entrance fee or' in Rule 9 be struck out, that Rule 12 be rescinded, and that the following New Rule be substituted for it :—'12. Ordinary Members shall each pay an Annual Subscription of 10s. Except that a Member elected between the 1st February and the 1st April in any year, shall pay a subscription of 5s. only for that year. Such subscriptions shall be payable in advance, and the first payment shall date from the 1st of October preceding the election of such Member, except the election take place from the 1st of April to the 30th September, both inclusive, when it shall date as on 1st of the October following.'"

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society.

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society, The Museum, College Square, N. Belfast.

Boston Society of Natural Science (Mass, U.S.A.).

British Museum, General Library, Cromwell Road, London, S.W.

British and American Archæological Society, Rome.

Cardiff Naturalists' Society, Frederick Street, Cardiff.

City of London Natural History Society.

Chester Society of Natural Science.

- Croydon Microscopical and Natural History Club, Public Hall, Croydon.
- City of London College of Science Society, White Street, Moorfields, E.C., and "Hatfield," Tenham Avenue, Streatham Hill, S.W.
- Department of the Interior, Washington, U.S.A.
- Edinburgh Geological Society, India Buildings, George IV. Bridge.
- Eastbourne Natural History Society.
- Epping Forest and County of Essex Naturalist Field Club, West Ham Institute.
- Folkestone Natural History Society.
- Geologists' Association.
- Geological Society of Mexico.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- London County Council, Horniman Museum.
- Leeds Naturalist Club.
- Lloyd Library, 224, West Court Street, Cincinnati, Ohio, U.S.A.
- Lewes and East Sussex Natural History Society.
- Maidstone and Mid-Kent Natural History Society.
- Mexican Geological Institute, 5A, Del Cipres, No. 2,728 México.
- Michigan University, Ann Arbor, Michigan.
- North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells Bladen, Secretary).
- Nottingham Naturalists' Society, University College, Nottingham.
- Peabody Academy of Science, Salem, Mass., U.S.A.
- Quekett Microscopical Club, 20, Hanover Square, London, W.
- Royal Microscopical Society, 20, Hanover Square, London, W.
- Royal Meteorological Society, Prince's Mansions, 73, Victoria Street, S.W.
- Royal Society, Burlington House, Piccadilly.
- Smithsonian Institute, Washington, U.S.A.
- South-Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Southport Society of Natural Science, Rockley House, Southport.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- University of Colorado, Boulder, Colorado.
- Watford Natural History Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS
OF THE
Brighton and Hove Natural History and
Philosophical Society,
1906.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton. Names printed in italics are Life Members.

ORDINARY MEMBERS.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.
ASHTON, C. S., 10, Powis Grove.

BILLING, T., 6, St. Michael's Place.
BOOTH, E., 53, Old Steine.
BULL, W., 75, St. Aubyn's, Hove.
BURROWS, W. S., B.A., M.R.C.S., 62, Old Steine.
BURCHELL, E., M.R.C.S., L.R.C.P., 5, Waterloo Place.
BLACK, MILNER, 81, St. James's Street.

CANE, H., 173, Ditchling Road.
CAUSH, D. E., L.D.S., 63, Grand Parade.
CHARRINGTON, H. W., 23, Park Crescent.
CLARK, J. COLBATCH, J.P., 9, Marlborough Place.
COLMAN, Alderman J., J.P., Wick Hall, Furze Hill.
CLIFTON, HARVEY, 19, Buckingham Place.

DAVEY, HENRY, 15, Victoria Road.
DENMAN, S., 26, Queen's Road.
DODD, A. H., M.R.C.S., L.R.C.P., 49, Church Road, Hove.
DALDY, MANTELL A., Dr., 17, Palmeira Square.
DUKE, Dr. E., 30, New Church Road, Hove.

FLETCHER, W. H. B., J.P., Bersted Lodge, Bognor.
 FAWSITT, H. G. CHATER, 14, Vernon Terrace.
 FORBES, GEORGE, 5, St. Peter's Place.

GILKES, J. H., Wychcote, Dyke Road Avenue.
 GRAVES, A. F., 9A, North Street Quadrant.
 GRIFFITH, A. F., M.A., 59, Montpelier Road.
 GROVE, E., Norlington, Harrington Road.
 GRINSTEAD, J., 13, Powis Square.

HALL, J. SUSSEX, 69, Ship Street.
 HACK, D., Fircroft, Withdean.
 HARRISON, W., D.M.D., L.D.S., 6, Brunswick Place, Hove.
 HASELWOOD, J. E., 3, Richmond Terrace.
 HAYNES, J. L., 24, Park Crescent.
 HENRIQUES, A. G., F.G.S., J.P., 9, Adelaide Crescent, Hove.
 HICKLEY, G., 92, Springfield Road
 HILTON, T., 1, Clifton Street.
 HOBBS, J., 62, North Street.
 HOWLETT, J. W., J.P., 4, Brunswick Place, Hove.
 HORA, F. R., B.Sc., B.A., A.R.C.Sc., 69, St. Aubyn's, Hove.
 HARRISON, F., M.A., 30, Compton Avenue.
 HORNE, J., 27, Hampstead Road.
 HAWKINS, W. B., Shalimar, Withdean.

INFIELD, H. J., Sylvan Lodge, Upper Lewes Road.

JENNINGS, A. O., LL.B., 11, Adelaide Crescent, Hove.
 JOHNSTON, J., 12, Bond Street.
 JONES, RUTHERFORD, Dr. A., Forest Lodge, Maresfield.
 JACKSON, J. M., 109, Stanford Avenue.

LANGTON, H., M.R.C.S., 11, Marlborough Place.
 LAW, J., Crosthwaite, Lewes.
 LEWIS, J., C.E., F.S.A., Fairwarp, Uckfield.
 LONSDALE, L., 13, Powis Square.
 LIVESEY, G H., M.R.C.V.S., Osmond Road, Hove.

MCKELLAR, E., Deputy-Surgeon-General, M.D., J.P., Woodleigh,
 Preston.
 MAGUIRE, E. C., M.D., 9, Old Steine.
 MERRIFIELD, F., 24, Vernon Terrace.
 MILLS, J., 24, North Road.
 MORGAN, G., L.R.C.P., F.R.C.S., 6, Pavilion Parade.
 MANSFIELD, H., 11, Grand Avenue, Hove.
 MORSE, ROBERT, 26, Stanford Avenue.
 MAURICE, H., L.D.S., 65, St. John's Terrace.

NEWSHOLME, A., M.D., F.R.C.P., 11, Gloucester Place.
 NICHOLSON, W. E., F.E.S., Lewes.
 NORMAN, S. H., Burgess Hill.
 NORRIS, E. L., L.D.S., 8, Cambridge Road, Hove.

OKE, ALFRED W., B.A., LL.M., F.G.S., F.L.S., F.Z.S., 32,
 Denmark Villas, Hove.

- PANKHURST, E. A., 3, Clifton Road.
 PAYNE, W. H., Playden House, Harrington Road.
 PAYNE, E., M.A., 6, Cambridge Road, Hove.
 PENNEY, S. R., Larkbarrow, Dyke Road Drive.
 PETITFOURT, E. J., B.A., F.C.P., 16, Chesham Street.
 PUGH, Rev. C., M.A., 13, Eaton Place.
 PUTTICK, W., Tipnoake, Albourne, Hassocks.
 POPLEY, W. H., 13, Pavilion Buildings.
 POWELL, W. A., M.R.C.S., L.R.C.P., 5, Grand Parade.
 PESKETT, CHALMERS, A. W., M.A., M.B., B.C., Cantab., Simla,
 Clermont Road.
 PESKETT, GUY, Simla, Clermont Road.
 READ, S., L.D.S., 12, Old Steine.
 RICHARDSON, F. R., 4, Adelaide Crescent.
 ROBERTS, J. P. SLINGSBY, 3, Powis Villas.
 ROBINSON, E., Saddlescombe.
 ROSE, T., Clarence Hotel, North Street.
 ROSS, D. M., M.B., M.R.C.S., 9, Pavilion Parade.
 READ, T., B.A., B.Sc., Brighton Grammar School.
 ROBERTSON, A., 17, Sackville Road, Hove.
 SALMON, E. F., 30, Western Road, Hove.
 SAVAGE, W. W., 109, St. James's Street.
 SLOMAN, F., M.R.C.S., 18, Montpelier Road.
 SMITH, C., 47, Old Steine.
 SMITH, T., 1, Powis Villas.
 SMITH, W., 6, Powis Grove.
 SMITH, W. J., J.P., 42 and 43, North Street.
 SMITH, W. H., 191, Eastern Road.
 STONER, HAROLD, L.D.S., M.R.C.S., L.R.C.P., 18, Regency Square.
 SMITHERS, E. A., Furze Hill.
 SPITTA, E., M.R.C.S., L.R.C.P., F.R.A.Sc., 41, Ventnor Villas,
 Hove.
 SOUTHCOMBE, H. W., 16, Stanford Avenue.
 SEAMER, ARTHUR, M.A., 9, Chatham Place.
 STANFORD, THOMAS CHAS., Preston Manor.
 TALBOT, HUGO, 79, Montpelier Road.
 TOMS, H. S., The Museum.
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 TYSSEN, Rev. R. D., M.A., 19, Brunswick Place, Hove.
 WALLIS, W. CLARKSON, 15, Market Street.
 WALTER, J., 13A, Dyke Road.
 WELLS, I., 4, North Street.
 WHYTOCK, E., 36, Western Road.
 WILKINSON, T., 170, North Street.
 WILLIAMS, A. S., 17, Middle Street.
 WILLIAMS, H. M., LL.B., 17, Middle Street.
 WOOD, J., L.D.S., 28, Old Steine.
 WOOD, WALTER R., L.R.C.P., M.R.C.S., L.D.S., 28, Old Steine.
 WELSFORD, H. M., 68, Dyke Road.
 WILLIAMS, A. W., M.D., Belvedere Terrace.

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HERNAMAN, V., Miss.
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Dec. 22, 19

BRIGHTON AND HOVE
Natural History & Philosophical
Society.

Extracts of Papers

READ BEFORE THE SOCIETY,

TOGETHER WITH

THE ANNUAL REPORT

FOR THE

Year ending June 6th, 1907.

Brighton:

"BRIGHTON HERALD" Printing Works, Prince's Place.

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BRIGHTON AND HOVE

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***PRES*E**N

.. TO ..

Alderman Colbatch Clark.



ALDERMAN J. COLBATCH CLARK, J.P.

Fifty Years a Secretary.

THE Society has the pleasure of announcing that Mr. Alderman J. Colbatch Clark, J.P., has attained his 50th year as Hon. Secretary. Mr. Clark (at that time J. C. Onions) took over the duties from Mr. T. B. Horne during the Session 1857-8, was then formally elected, and has continued in office to this day—a term of work as Secretary probably without precedent in the annals of any Society. Mr. Clark has worked with no less than thirty-seven Presidents. It was universally felt that any possible recognition must be perfectly trifling in comparison with the value of Mr. Clark's services; but the members, past and present, subscribed for a silver salver and an illuminated address, which were presented to Mr. Clark at the Annual Meeting on June 6th. Such an event naturally drew considerable attention, as the following selections from the Press notices will show:—

[*Sussex Daily News*, June 7th.]

When the members of the Brighton and Hove Natural History and Philosophical Society yesterday evening at the Royal Pavilion re-elected Alderman J. Colbatch Clark, J.P., as Hon. Secretary, they had the unique pleasure of launching him upon his fiftieth year of office. So remarkable an occasion was very properly treated in an exceptional way, and the Alderman found himself the recipient of two permanent souvenirs of his half-century association with the work of the Society. One was a handsome 18-inch silver salver, with ornate shell border, and elaborate engraving; the other was a beautifully illuminated album containing an address, with the names of 79 subscribers. The salver, which bore a suitable inscription, was the artistic production of the Sussex Goldsmiths and Silversmiths' Company, Castle-square, Brighton; and the address was the no less skilful production of Miss Hudson, of the Brighton School of Art. The latter read:—

DEAR SIR,—This album contains the names of past and present members of the Brighton and Hove Natural History and Philosophical Society, who desire to make some recognition of your services for the period of fifty years during which you have acted as Honorary Secretary to the Society. So long a service in an honorary position is a very rare and probably unprecedented circumstance in the history of any Society. In addition we recall that in the general management of the Society and in all your relations with its members you have always shown the

greatest tact, zeal, and courtesy, coupled with remarkable business capacity ; and we feel that the present prosperity of the Society is mainly due to you. Slight as any recognition we can make must be in comparison with your services, we venture to ask your acceptance of the accompanying silver salver and our warmest wishes for your present and future welfare.

Signed, on behalf of the subscribers,

WALTER HARRISON, President.

Mr. J. E. Haselwood, a Vice-President, was the mouthpiece of the members in presenting these gifts, and he enthusiastically recalled the fifty years of solid work done by Alderman Clark in looking after the finances and business details of the Society. Speaking with forty years' experience, he declared unhesitatingly that but for the careful watch Mr. Clark had kept upon their funds, the Society would have been dead years ago. With it all Mr. Clark had been always courteous, and able to smooth over any difficulties that arose. Mr. Clark had done this, realizing that the Society was an important element in the life of the town which had been an influence for good in many directions. He had also played a prominent part in fostering the social side of the Society, and was for many years the moving spirit in the soirées, and in the annual excursions. In handing him the salver, he said its modest weight carried with it a vast amount of sincere affection.

Enthusiastic applause greeted Alderman Clark when he rose to thank the members. In a happy speech he said it was a matter for congratulation that the Society had been able to exist so long, and he hoped the end of the present century might find it still flourishing. Personally he felt it an honour to have been associated with the work for all these years, though his duties had been of a purely business character, thanks to the wise arrangement of having another Secretary to look after the scientific side. He had had a great reward in the instruction and enjoyment obtained from the Society's lectures, which had enabled him to understand the early developments of telegraphy, electricity, bacteriology, and the like, which were casting their shadows before them in the early days of his acquaintance with the Society. He recalled the interesting fact that at one of the first lectures he attended on telegraphy, the lecturer assured them that one day the messages would be sent without the medium of wires. Of the original members of the Society there were only now two living, Mr. Barclay Phillips and Mr. Geo. de Paris. He said, in conclusion, he would be proud to hand the presentation as heirlooms to his successors, together with the clock which they presented to him 35 years ago.

The President, Mr. Walter Harrison, and four past Presidents, Mr. E. A. Pankhurst, Mr. Douglas E. Caush, Mr. Clarkson Wallis, and Mr. Henry Davey, supplemented the eulogies passed

upon the Alderman, the last-named mentioning that Mr. Clark had seen six or seven Scientific Secretaries, six or seven Librarians, and as many as 33 Presidents.* Mention may also be made of a letter received from Councillor Booth, who wrote that he had known Mr. Clark from childhood, and that he deserved all good things from his fellow townsmen.

[*Brighton Society.*]

LAST (Thursday) evening the celebration of a most remarkable event occurred, when Mr. Alderman Colbatch Clark attained his fiftieth year of office as Honorary Secretary of the Brighton Natural History Society. So long a continuance in any such post must be rare in the extreme, and is probably unprecedented, for the start must have been made unusually early in life. Mr. Clark was presented with a handsome silver salver and a beautiful album containing the names of the subscribers, and designed by Miss Hudson, of the School of Art. The presentation was made by Mr. J. E. Haselwood, an old member, in well-chosen terms, and Mr. Clark feelingly responded, detailing some early recollections on scientific matters. It was mentioned that two of the original founders in 1854, Mr Barclay Phillips (now of Bedford) and Mr. G. de Paris, are still living; and Mr. Merrifield, still active in his profession, was on the Committee in 1856. Mr. Clark, during his half-century of office, has known thirty-three Presidents of the Society.

[*Brighton Herald.*]

A REMARKABLE record, probably a unique record, was celebrated on Thursday night by the members of the Brighton and Hove Natural History Society. This was the attainment by Alderman Colbatch Clark of his fiftieth year of office as Hon. Secretary to the Society. The completion of so remarkable a period of office was fittingly honoured by the Society presenting Alderman Clark with a massive silver salver, of handsome design, and an illuminated album containing the names of the past and present members of the Society who had subscribed. This presentation took place at the fifty-third annual meeting of the Society at the King's Apartments.

The importance that the members attached to the occasion was clearly indicated in the manner in which one of the oldest

members of the Society, Mr. J. E. Haselwood, set himself to make the audience realize what was involved in a secretaryship which contained fifty years of solid work,—the amount of writing, of attendance at meetings, and all the other routine. All the time Alderman Clark had been unfailing in courtesy and good temper. But for the care he had bestowed on the finances, the Society would have been dead many years ago. He had had to look after excursions and soirées, and other incidents of the work. Alderman Clark had in fact been of inestimable service to a Society which Mr. Haselwood felt had had an important bearing on the intellectual development and social enjoyment of so many people in the town, and thereby had been of material service to the town itself. In handing Alderman Clark the salver, Mr. Haselwood assured him that it carried with it a vast amount of sincere affection.

The salver bore an inscription, and with it came the vellum bound album containing the names of seventy-nine subscribers and the following address :

DEAR SIR,—This album contains the names of past and present members of the Brighton and Hove Natural History and Philosophical Society, who desire to make some recognition of your services for the period of fifty years during which you have acted as Honorary Secretary to the Society. So long a service in an honorary position is a very rare and probably unprecedented circumstance in the history of any Society. In addition we recall that in the general management of the Society and in all your relations with its members you have always shown the greatest tact, zeal, and courtesy, coupled with remarkable business capacity ; and we feel that the present prosperity of the Society is mainly due to you. Slight as any recognition we can make must be in comparison with your services, we venture to ask your acceptance of the accompanying silver salver and our warmest wishes for your present and future welfare.

Signed, on behalf of the subscribers,

WALTER HARRISON, President.

Received with enthusiastic applause, Alderman Colbatch Clark made a happy response in a finished speech and with a sturdiness of manner that showed he is very far yet from feeling the wearing effects of so long a service. He made very modest allusion to his own work for the Society, but rather directed attention to the work of the Society, and to assuring his hearers that he had benefited immensely by his association with it. He supposed that the fifty years in which he had been connected with this scientific Society had been the most eventful half-century in the history of science ; in no other period had it made such great strides. Thanks to his association with the Society, he had been able to take an interest in the scientific progress and to realise what it meant in a way that, without the Society, would have been impossible. He could not, of course, attempt to outline the changes in science that he had known, but there were

one or two things in which he had a direct personal interest, great discoveries whose shadows had been projected on his earlier days in a way that made the later substantial realization of great interest to him. He remembered how, when the electric telegraph was a new thing of which all were talking, a gentleman assured him that in some future day people would send electric messages without wires. Sixty-one years ago he went to a lecture where the lecturer said he believed it would be quite possible to convert electricity into motive force, but that the force would be of little practical use because one could not make sufficient electricity. He thought of this when he saw the huge machinery thundering at the Corporation works. A third modern discovery projected across his early days was the theory of bacteria. Alderman Clark drew attention to the fact that two of the original members of the Society are still alive in Mr. G. de Paris and Mr. Barclay Phillips. This salver was not the first presentation the Society had made him. Thirty-five years ago they presented him with a clock ; "it is still going." Alderman Clark added that he could not have done the work so long had not the Society given him so valuable an assistant in Mr. Henry Cane.

The Chairman (Dr. Harrison), in adding his tribute of praise, reminded the meeting of the work Alderman Clark did apart from the Society. His townspeople elected him to the Council ; the Council elected him an Alderman ; and the State recognized his value by making him a J.P.

Other testimony of praise came from four previous Presidents of the Society,—Mr. E. Alloway Pankhurst, as representing physical science ; Mr. D. E. Caush, as representing the microscopic side ; Mr. Clarkson Wallis, representing, in his own words, the amateur in Science ; and Mr. Henry Davey, from the philosophical side. Mr. Davey pointed out that Alderman Clark had seen six or seven Scientific Secretaries and thirty-three Presidents.

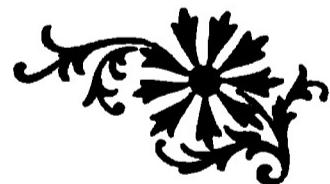
A letter was read from Councillor Booth, who said that he had known Alderman Clark from childhood, and could testify that he deserved all good things from his fellow townsmen.

The salver, it should be mentioned, was executed in effective style by the Sussex Goldsmiths and Silversmiths' Company, Castle Square, Brighton, and the illuminated album was the artistic work of Miss Hudson, at the Brighton School of Art.

The leading scientific journal of England also deemed the occasion worthy a special recognition, as the following paragraph shows :—

[*Nature*, June 13th.]

THE Brighton and Hove Natural History and Philosophical Society has for fifty years had Alderman C. Clark as its Honorary Secretary. So long a service in a position of this kind, involving much work and expenditure of time, is very remarkable. In recognition of the active part Alderman Clark has taken in bringing the Society to its present prosperous condition, a massive silver salver and an illuminated album containing the names of many past and present members was presented to him at the fifty-third annual meeting on June 6th.



OFFICERS OF THE SOCIETY, 1906-7.

(For List of Officers, 1907-8, see page 60).



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WALTER HARRISON, D.M.D.

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D. E. CAUSH, L.D.S.	E ALLOWAY PANKHURST.
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F. HARRISON, M.A.

Honorary Secretary :

JNO. COLBATCH CLARK, 9, Marlborough Place.

Assistant Honorary Secretary :

HENRY CANE, 9, Marlborough Place.

SESSION 1906-7.

Address given by the President,

WALTER HARRISON, D.M.D., L.D.S.,

At the Conversazione held at the Royal Pavilion, Oct. 18th, 1906.

The Communication of Thought.

Ladies and Gentlemen,—

In thanking you for the honour you have conferred on me by electing me to the position of President of this Society, founded more than half-a-century ago, I recognise how difficult it will be to follow in the steps of such a line of talented men as have preceded me. My lot is especially hard as my immediate predecessor, Mr. Henry Davey, was such an able and genial gentleman—one of the best of those who have occupied the presidential chair—that by the unanimous choice of the members he was elected for a second year, the longest period that the rules of our Society allow.

I have to express one regret when I look round the room, that is, how few young people join our Society. If during my year I can persuade our younger folk to become associates at least, I shall feel that I have done something, not only for the Society but for the community at large, as I can confidently affirm that no one can attend our lectures and converse with the members without learning much about many things.

I have re-introduced in a small way the Conversazione, which used to be an annual one; I hope also to re-establish the annual Banquet, and I shall ask your support in making a whole day excursion in the summer of next year. The syllabus of our lectures will, I am sure, commend itself to you as being of the same high standard as in past years; and I may add we hope to supplement the monthly lectures by a monthly visit to some place of interest, on the lines started by Mr. Davey.

With these prefatory remarks I will now direct your attention for a few minutes to another subject—

“And the dove came unto him in the evening, and lo, in her mouth was an olive leaf pluckt off. So Noah knew that the waters were abated. . . .”

"Williams, the foreign missionary, had one day forgotten his square, and taking up a shaving he wrote a request to his wife to give it to the bearer. He gave this to a native chief, telling him to take it to Mrs. Williams and return quickly to him. On his delivering the written message to the missionary's wife, the native was much surprised at receiving the square, and on his return to Mr. Williams expressed his astonishment at a shaving producing the instrument. The missionary tried in vain to explain the simple way in which a thought could be communicated. So mystified was the chief that he wore the wonderful shaving round his neck and showed it to his followers as a marvellous charm."

"Recently during a voyage across the Atlantic ocean, copies of a daily paper were circulated among the passengers containing the news communicated by the Marconi wireless telegraphy."

These three statements so impressed me that I decided to make them the basis of the short address which falls to my lot as your President. I shall call it—"The Communication of Thought."

To what extent the lower orders of creation are capable of communicating their desires we are unable to decide; but that they do possess such power we know. Nor is it confined to their intercommunication, for dogs, at least, have been known to communicate their wishes to man when their masters have been in danger, &c Ants, too, and some other small creatures, have this power of communication, as those who study their habits know.

It is possible to conceive of the communication of thought through any of the channels of the senses. Taste and smell might have become the means of conveying an idea, and to the lower orders of creation it is undoubtedly so; but with man we must confine our attention to three of our senses—Touch, Sight, Hearing.

Tactile language has been observed in bees; I may mention the well-known instance of their communicating to each other the death of a queen by a rapid interlacing and striking of their antennæ. Mankind makes but a limited use of this sense for communicating his wishes but under circumstances when an appeal cannot be made to the ear or the eye it satisfies the condition. A nudge is at times quite significant of an intention. To what extent thought-readers take advantage of touch, I am not able to say; but I do think that they can ascertain to some extent the thought in their companion, in such instances as searching for something hidden by the person, whose hand the reader of thought detains during his search.

The chief use of tactile language in the service of man is that employed for the blind. The raised letters become a ready means of enabling those to read who are unhappily deprived of, perhaps, the greatest of the senses. One of the early and most useful systems was that invented by a Brighton man, Dr. Moon. It has been asserted that by touch the blind can distinguish colour, but in the course of conversation with a very intelligent blind friend, I was informed that there is no truth in the statement; but it is true that they associate colour with sound, of which I shall have more to say presently.

But the two chief channels for Thought Communication are —the eye and the ear. The language for the eye is exhibited in the Arts and in gestures. Pictures, however rudely drawn, can reproduce in others the thought of the draughtsman, and this form of writing is known to all as Hieroglyphics. The name of each letter of the alphabet is the name of some object, and the form of the object is a rude representation of it.

Pictures developed into letters on one hand, and into works of art on the other. I think that in painting and sculpture the test of the artist's genius is the power that he possesses of reproducing in the mind of the observer the thoughts he had in producing his work of art. A picture that requires copious explanation has, in my opinion, an acknowledgement of failure accompanying it.

I need only refer to literature to show to what an extent we receive communication of thought by means of the eye. In poetry what thoughts are aroused in us by a few words ! And yet when we ponder over the matter we need not be surprised at the amazement of the native chief. What real connection is there between the printed letters D-O-G and the animal ? At first sight none ; but when the word is traced from its earliest form we can see how the letters convey the idea, and to this I shall again refer when saying a few words on sound as a means of conveying thought.

The Language of Gesture, which accompanies emotion, is at all times significant, and this is *par excellence* the language of the tragedian. Whoever has seen the late great actor, Sir Henry Irving in *The Bells*, knows what an ocean of thought is communicated by a few words, when accompanied by gesture. When Garrick first appeared, the orthodox critic complained very much of his not following the rules of elocution, as they knew them. One of these critics said that the great actor actually made a pause between the subject and the predicate in a sentence ! On being further questioned he admitted that Garrick at the pause introduced an effective gesture.

To what an extent Gesture is employed to teach the deaf and dumb, and as a means of communicating thought to them, you all well know. The Oral System, as it is called, has now

displaced the older system of finger alphabet, and it is simply wonderful how rapidly a long communication can be made.

A few years ago I gave a lantern exhibition—I cannot call it a lecture—to a Deaf and Dumb Institution, and proceeded to throw a few slides on the sheet. The intense silence that reigned was at first a little disconcerting. One expects at least some slight show of appreciation from time to time under such circumstances. But one thing I did notice, and that was a number of fingers made signs and then the Principal—who possessed the power of speech—requested me to say a few words on each picture. I did so, and then he communicated my remarks to the speechless audience with wonderful rapidity. At the conclusion, I was thanked in the name of the silent audience for the strangest experience it has fallen to my lot.

We will next consider sound as a means of thought. Dean Farrar in his chapters on language shows the analogies of light and sound :—

Sound corresponds to Sheen.	
Clear Sound „	Brightness.
Echo „	Reflexion.
Noise „	Glimmer.
Tone „	Colour.

I have just mentioned that blind people connect colour with sound and I would like to add a fact, told me by a friend. While he was a student at college he was talking to a fellow student, who was blind, and asked him what he thought of red colour. He replied that he thought it was like the sound of a cornet ! My friend remarked that he was not far from the truth as red was rather a *loud* colour !

In his Manual of Psychology, Dr. Stout says :—In all language there are traceable certain comparatively elementary phonetic components, called roots, expressing primary universals, or products of conceptual analysis, and these roots variously modified and entering into various combinations express conceptual synthesis or discursive thinking. They blend and combine in continuous speech, just as the corresponding concepts blend and combine in continuous thought. This is possible because of the ultimate unity of composition of the phonetic material, which is resolvable into elementary alphabetic sounds which do not occur in isolation but as parts of an articulate complex.

Attempts have been made to explain the origin of language without emphasizing the importance of the visible gesture as a starting point. There are three main theories of this kind, which have been nicknamed by Max Müller the Pooh-Pooh Theory, the Bow-Bow Theory, and the Ding-Dong Theory. Their more pretentious titles are the Interjectional, the Onomatopœic, and the Pathognomic Theory. The principle involved in all these theories

is essentially the same. They all attempt to trace back conventional signs to natural signs, but they exclude from consideration visible gestures and confine attention only to vocal signs.

It is evident that to mimic the mewing of a cat, in order to convey the idea of that animal, is as much an imitative gesture as going on all fours and humping the back for the same purpose. It is mimicry of this kind on which the Bow-Bow Theory relies for explanation. The same holds good of imitating a cry of fear, in order either to convey the idea of the emotion or of the approach of a dangerous object. This is a sort of expressive sign which is most primitive according to the Pooh-Pooh Theory.

The Ding-Dong Theory is more subtle, and it has the distinction of being advocated by Professor Steinthal. According to it specific kinds of objects so affected primitive man as to elicit from him, or, to use Max Müller's metaphor, to ring out of him, correspondingly specific utterances. The most primitive words would, therefore, be phonetic types rung out from the organism of the first man, or men, when struck with an idea. There is a harmony of sound and sense which does not depend on the imitation of one sound by another. The charm of literary style, and especially of poetry, consists largely in the subtle affinity between vocal expression and the objects or activities expressed, which may exist apart from any resemblance of sounds to one another. The word zig-zag is a good illustration. The zig goes this way and the zag goes that way, thus describing a zig-zag course.

In discussing the objections to the imitative theory, Dean Farrar said:—Is there no similarity between dog and barking and snarling? The Icelandic doggr looks very like a growl. . . and in other languages the word is distinctly initiative. . . A name bow-bow might have been invented, yet, strange to say, we hardly ever find a civilised language in which a dog is so called. . . Now it is at least doubtful whether the bark is a dog's natural utterance, and whether in its original state the dog did bark. . . No wild dog knows how to bark! Prichard mentions the conjecture that the dog's bark originated in an attempt to imitate the human voice! . . . Dogs were left by Spaniards on Juan Fernandez, after thirty years the race had forgotten how to bark.

Mechanical means for communicating thought.

Let us briefly consider the employment of moving objects, commonly known as the "Optical Telegraph." Its origin cannot be easily determined. It is said to have been used during the erection of the tower of Babel. Watch towers are mentioned as having been used by Hannibal, which he employed as signal stations, and the Romans had their telegraphic places. Modern employment of Optical Telegraphy is known under the names

of the Semaphore, Heliograph, and Flag-Signalling, and is of considerable use when electric telegraphic wires have been cut. The Heliograph was largely used in the late war in South Africa, as you well know.

In 1684 (Philo. Trans.) Hooke's system is described as having figures which moved in daylight and a screen with a light at night. In 1784, Edgeworth introduced posts and a cone, which was movable and indicated certain letters by the change of position. By combining posts with arms attached to a beam moving up and down, Chappe invented a system with a very elaborate code. Thus at the end of the Eighteenth Century practical telegraphy was an accomplished fact and remained in use until 1849.

In England, Lord Murray's system was adopted, which was a series of shutters. Macdonald and Pasley extended the use of this invention under the name of a Universal Telegraph.

The result of the Battle of Trafalgar was telegraphed from Portsmouth to London in about twenty minutes by means of the semaphore. The signal system was perfected to such an extent that messages could be sent from Calais to Paris in about three minutes.

Early in Nineteenth Century the practical results obtained by the application of electricity were recognized and utilized. The names of Cooke and Wheatstone ought to be always associated with electric telegraphy. Although the method was an optical one, yet the operators who were skilled in their work could interpret the message by the click of the instrument alone. Morse's invention reduced the message to printing by means of the dot-and-dash system. But in the natural course of events, man ever desirous of reducing labour to the minimum, directed his attention to more rapid means which results from sounds, and returned to the earlier method of "Noises," and, applying the latest discovery of electrical science, produced the telephone. Bell and Edison have been the means of bringing this method of communication to our homes.

I need only mention the name of Marconi to illustrate the latest development in telegraphy, and it will be in the memory of most present that we had a splendid lecture by Professor Fleming, who explained wireless telegraphy in such a manner that it ceased to be a mystery to those who had the privilege of hearing him.

To enter into the consideration of communication with the spirit world would be to discuss a subject more suitable to form the matter of an ordinary meeting, in which discussion is invited; but this much may be said, that after the elimination of all traces of charlatanism very remarkable coincidences—for the want of a better word—do occur. The correspondence in the *Daily Telegraph* has been very interesting to me as I am a great

dreamer, but I have never had any striking warning communicated to me. I have carefully noted on waking certain dreams and watched for the results. I can very often associate my dream with some event that has preceded it—which coincides with the experience of Herodotus, who lived more than two thousand years ago,—the details being much altered. I have also noticed in case of many strange dreams of others that the dream has been remembered *after* the event has happened. I do not wish it to be understood that others may not possess what is lacking to me, but I have noted how many of these remarkable communications have been of trivial moment.

Telepathy is the feeling or experiencing of sensations at a distance from another person. It occurs, it appears, when the mind of one human being affects the mind of another, but not through one of the recognized organs of sense. I have read and heard of many wonderful examples of this kind, but as I have never experienced such I will not pronounce an opinion on telepathic communications.

When we glance around us at the marvellous progress in communication of thought, how that distance has been annihilated by the speed of the transmission, we may well ask ourselves what has been the influence upon mankind? Has it increased our happiness? What are the benefits and what the disadvantages? Restlessness—the yearning for something fresh— inability to concentrate thought upon a subject. Decadence in all branches of Art, because there is no time to cultivate taste. Scholars are displaced by half-educated men who can and will produce the article in demand—a something that will not tax the intellectual powers. Learning and literature become but pastimes for those of means. Thoughts expressed in books and in colour become a drug in the market. What is the proportion of light literature compared with real standard works issued from our lending library? In spite of the re-publication of so many volumes of classics at a shilling by various firms, I fear that the number who read them is but small. What we desire to see is that the original thinker shall receive the reward to which he is so justly entitled. Increased facilities bring increased indifference; indifference begets thoughtlessness; and thoughtlessness, idleness; which too often marks mankind.

With regard to the reception and transmission of thought it is not difficult to come to a conclusion—that man being “inquisitive,” his desire to receive is greater than to transmit. A thoughtful man will always command a large following,—probably not during his life, perhaps centuries even may elapse before justice is done to him; but posterity will recognise him though it be tardy. The explanation is simple—the majority do not think; they are quite content to let others think for them.

Strange as it may seem in our daily reading of Marconigrams, telegrams, telephonic communications, that side by side with the latest developments primitive forms of inter-communication should be still employed. Signalling by mechanism, bird-messengers, and even beacon fires are yet with us—and this fact recalls to our minds the words of Tennyson :—

“ Men, my brothers, men the workers, ever reaping something new ;
 That which they have done but earnest of the things that they
 shall do—
 Yet I doubt not through the ages one increasing purpose runs,
 And the thoughts of men are widened with the process of the suns.”

THURSDAY, NOVEMBER 15TH, 1906.

Forest Life.

BY

MR. MARTIN DUNCAN,

Illustrated with Lantern Slides.

BY being a Member of the Brighton and Hove Natural History Society one gets to acquire a knowledge of the intimate details of animal life, like Sam Weller's knowledge of London, extensive and peculiar. Knowledge of this kind was freely imparted by the lantern lecture given by Mr. Martin Duncan. Mr. Duncan, who must be a naturalist of the first order, was trying to rear a young cuckoo. He found it as fractious and trying as the ordinary human baby, and it was always waking him in the night for food. He had a happy inspiration. He had observed that a mother thrush, when worn out, as all mothers do get worn out, with the exertion of feeding her infant, adopted a neat strategem to save herself the trouble of hunting for more worms and at the same time satisfying the cries of the baby. When the baby opened its beak to cry for more the mother inserted her own empty beak, and tickled the youngster's palate. Baby thrush, innocent of the world's ways, concluded the mother had put a nice fat worm in its mouth, gulped, and was quite happy,—till the next time. So Mr. Duncan, when the cuckoo cried for worms and there were none

handy, put his hand out of bed, and touched the inside of the creature's mouth. Baby cuckoo gulped, and it and he sank down again to repose. Mr. Duncan seems to understand birds just as if he were Mr. Barrie's Peter Pan. Like Peter, all that he lacks is feathers. Incidentally he mentioned several instances where he has fulfilled the rôle of parent to fledglings, with excellent photographic results.

In attempting to photograph the young of the meadow pippit Mr. Duncan had personally experienced the extraordinary intelligence and devotion of the mother bird in protection of her young. The male bird sought first to attract his attention away from the nest, but this failing, the mother, as a last extremity, went hopping, flying away just out of reach, with every appearance of a broken wing. Evidently the bird's idea was to make him think he was on the point of catching her, and so lead him further and further from the nest. The mother wry-neck, found at the bottom of a tree-trunk hatching, startled him with a sound as if she had smashed all the eggs and flew whirring straight at his face. She may have meant him to think that the eggs were broken ; but they were safe enough. And Mr. Duncan delighted his audience with photographs of the newly-hatched fledglings, as they peeped timorously from the hole in the tree looking out on the strange, big world. The lecturer had photographs of rabbits just emerging from their burrows. The old master buck always came out first, after the general stampede caused by an alarm. After satisfying himself that danger was gone, he would go round the other burrows stamping with his paw as a sign that the inhabitants could come out. Lying under a gorse bush, Mr. Duncan snapped them at interesting moments.

An amusing comedy touch came with his pictures of owls. One showed the owl placidly indifferent. The next, its great solemn eyes wore an aspect of surprised inquiry, until by varying stages, it worked up into a state of protesting indignation at the whole nefarious proceedings. The attitudes of the creature would have made the fortune of a comedian. Mention of owls brought Mr. Duncan to a ghost story. Once, in a village in Cornwall, he heard affrighted villagers in the taproom telling of ghastly noises and a visible ghost proceeding at night from Squire Somebody's tomb. All agreed that the old Squire's ghost snored. He determined to investigate. From the tomb—an old-fashioned family-vault type—certainly the weirdest of noises were proceeding,—muffled groans and cries, and a distinct loud snoring. The mystery was explained when two barndoors owls came whirring out, protesting angrily at his disturbance. The owls had found a hole in the tomb, and were bringing up a family inside. The groaning snoring sounds were their way of expressing anger when disturbed by nocturnal passers-by. So another ghost was laid.

His observations and his photographs were no less interesting among the insects. He had a series showing the evolution of a pupa into a peacock butterfly,—the emerging of the butterfly, its drying of its wings, its preliminary trials of those wings before launching out on the new aerial life. Astonished once to see a bee, gathering honey on the bee-orchis, recoil as if struck by a deadly wound, he examined the orchis, and found that what appeared new buds were really spiders, lying in wait for bees and relying on their resemblance to the flower. Later in the season, as the bees sought other plants, the spiders followed. Deprived now of the aid of mimicry, the spider used its arts dodging about the flower, playing at hide-and-seek with the bee, until it got into a favourable position to leap out from its hiding-place and strike. Mr. Duncan had even photographs of the ferocious larvae of the dragon-fly and water-beetle fighting. Enlarged on the screen, these fantastic creatures looked like nothing so much as some of the scaly dragons painted on the walls of the Pavilion meeting in pitched battle.

These photographs, it appeared, were all obtained in the New Forest, where Mr. Duncan had spent many months stalking his birds and insects. Among many adventures was one that landed him up to the armpits in a bog, from which he was an hour in extricating himself. Naturally Mr. Duncan had many interesting things to say about the people who live in the Forest and their customs, which include many survivals of Saxon times. Further, he had many photographs of purely pictorial interest, and these were of great artistic beauty.

An important warning issued by Mr. Duncan deserves the widest publicity. What with professional collectors and the mania of the modern teacher for sending children into the country to collect flowers, eggs, and everything else, many of our species of wild birds and wild flowers are now within measurable distance of extinction. At the beginning of this year he noted twenty-four different nests for making observations upon. When the time came for those observations, he found that collectors had taken every egg from every nest. He pleaded for some law to stop these depredations. Mr. Duncan mentioned other facts which went to show what grave mistakes are made by men when they destroy the balance of nature by exterminating some species in fancied self-interest. The people in the New Forest complained that the deer did damage to their pasturage, and an order was issued to exterminate the deer. Now they have not half the pasturage they used to have, and the amount is growing less and less. Gorse is encroaching on every side from lack of the deer to eat the young growths and so keep it within bounds.

TUESDAY, NOVEMBER 20TH, 1906.

Kalahari Desert and Ngamiland.

BY

MR. H. W. HODSON.

Illustrated with Lantern Slides.

IT is a far cry from the "great thirsts" of the Kalahari desert, where one cuts open the paunch of an animal to see if there is anything drinkable inside, to a lantern lecture to the Natural History Society in civilized Hove. The gap has recently been traversed by Mr. H. W. Hodson, son of the Dr. Hodson who has been a well known member of the Hove Town Council. Mr. Hodson is an official of the Colonial Office, and has been stationed in the Bechuanaland Protectorate. Out there he has had a close personal acquaintance with the various peoples and with the country, while he seems to have had a good time hunting game. He has even shot a lion. Mr. Hodson, now home on holiday, told the Natural History Society of some of his adventures and observations, adding greatly to the interest of what he had to say by excellent photographs shown by the lantern. Very modestly did he tell how he became possessed of the splendid lion skin he was able to show. He heard a rare commotion among the baboons in the forest, and learning that it meant a lion was on the warpath, he went in search. He saw the lion in a great rage. He had killed a baboon, and the other baboons were teasing him, in revenge, and making him very savage. But the first time he saw Mr. Hodson the lion, apparently rather over-wrought, bolted. The second time, Mr. Hodson came suddenly upon the great beast. He was fairly cornered ; impenetrable scrub behind, a lion in front, growling, and getting ready to spring. "I felt," said Mr. Hodson, "that it was no place for me. I fired, and, luckily, my first shot did all that was necessary." And he gave a vocal imitation of the noise the animal made as, checked in its spring, it rolled over and died. Mr. Hodson had another curious hunting adventure, which, he admitted, sounded like a traveller's tale. He shot a hartebeest, putting two bullets into it. The animal fell, apparently dead. He went up to it, and started cutting its throat. He had just severed the wind pipe, when he was called away. On returning he was amazed to see the animal jump up and run off. Assuming that it could not go far, he and a

Bushman went in pursuit. They followed it, the animal apparently always about to be taken, until they discovered they were bushed and night was falling. They had to spend the night in the forest, and return without the animal. Next day he sent a man to try and find it, but the man never came back, nor had he heard of him since. Whether the hartebeest killed him, or whether he chose to desert, no one could say.

A tragic incident was touched upon by Mr. Hodson. He was talking about the "great thirst," the suggestive name given to a track of the desert where one journeyed for five or six days without finding a drop of water. Crossing this terrible "thirst," he found the body of an Englishman. "The vultures and jackals had got there before me, so I will say no more about that." Underneath the head was a letter. Mr. Hodson read the letter to his audience. Terrible in its pathetic brevity, it told how the writer was dying of thirst, that he had no strength left, and it gave directions for the disposal of certain property. "I am dying; . . . a little water would have saved me." But the most pathetic portion of all was the dying man's thought for his relatives. He did not wish to harrow them with the knowledge of how he died; "tell them I died of fever."

Mr. Hodson was able to tell his audience much about the Kalahari desert and of that beneficent provision of nature, which, while depriving the land of water, allows for the growth of melons, from which the natives obtain both food and drink. He protested against the common idea that the Bushman was altogether a degraded person; he might not have much intellect, but in knowledge of the conditions under which he lived and of his surroundings he was not to be excelled. He knew all the lore of nature around him. Another misconception to be dispersed was that the ostrich seeks safety by burying its head in the sand. His own experience was that as soon as you startled an ostrich it was off at the speed of a motor-car, and was soon out of sight.

Besides the Kalahari desert, Mr. Hodson had spent some time in Wgamiland, which is as well watered as the desert is dry, and his observations on these two districts supplied his audience with much interesting matter.

The President of the Natural History Society, Dr. Harrison, mentioned that Mr. Hodson has been elected a Fellow of the Royal Geographical Society.

MONDAY, DECEMBER 10TH, 1906.

The Making of Scenery.

BY

MR. H. EDMONDS, B.Sc.

Illustrated with Lantern Slides.

"THE Making of Scenery" formed the subject of a lecture delivered at the Royal Pavilion to the members of the Brighton and Hove Natural History and Philosophical Society by Mr. H. Edmonds, B.Sc. Dr. Harrison presided. The lecture had little to do with the effect produced on hill and sea by light and atmosphere; but it dealt in a very interesting fashion with the preparation by Nature of the raw material of beautiful effects. The awful powers of Nature in transforming the appearance of the world's surface was Mr. Edmonds' theme. In illustration of his points, he shewed a number of excellent pictures on the screen, many of which had been prepared for the meetings of the British Association. Some of the scenic effects portrayed were very remarkable.

THURSDAY, JANUARY 17TH, 1907.

The Variation in Domestic Fowls.

BY

MR. GEORGE FOXALL.

Illustrated with Lantern Slides.

WHICH came first, the hen or the egg? Addressing the members of the Natural History Society on "The Variation in Domestic Fowls," Mr. George Foxall confessed that he had nothing to add to the solution of a problem which has worried man ever since he could think, but he could say something about the beginnings of new species of hens and eggs. At first sight one would as soon expect the learned members of

the Brighton and Hove Natural History and Philosophical Society to listen to a lecture on the domestic mangle as upon the domestic fowl. The fowl is so very suburban and back-yardian, unhappily for those who live in the suburbs and next to those back yards. But it did not take Mr. Foxall long to convince his hearers that in the study of the domestic fowl there is an enormous amount of natural history and quite a considerable amount of philosophy. The fowl, so one gathered from Mr. Foxall, is one of those things that man has decided Nature could not create properly by herself, and man has set himself to assist Nature in making fowls as he considers fowls ought to be made. The fowl is wonderfully docile to this sort of treatment. A dozen years of judicious assistance to Nature will often evolve an entirely new species of fowl, not a mongrel, but a pure-blooded variety that will go on breeding its own kind. But, alas, Mr. Foxall had to confess that the breeder's successes in the eternal war with Nature which constitutes the fowl breeder's life are only temporary. Nature is too strong for man, and she wins in the end. He was convinced that all these new breeds were doomed to what was a comparatively quick extinction, and that Nature would pursue her undisturbed course, creating fowls, of the half-dozen elementary types that she bred in the Indian jungles when the natives of Great Britain demanded no other clothing but a coat of blue paint.

At present, however, man finds it a highly interesting and lucrative operation inventing new breeds of fowls. He decides that one class of fowl would look much better if it resembled a swan, and he matches birds of long necks, until at length a bird is produced that seems trying to emulate a giraffe. Unhappily, if these elongated creatures are left to themselves, they speedily revert to their original short necked type. Or else man, with an eye to his dinner, sets himself to enlarge the plump, meaty breast, or extend the length of the back. An artist will seek to develope feathers in some particular position, on the head, for instance, till he gets his fowl to resemble a chrysanthemum. He will provide special "moustache cups" for those curled darlings, so that, in drinking, they should not get their fine feathers or heavy beards put out of curl. If he is very fastidious, he will eschew all fowls that erect their tails above an angle of sixty degrees, and mate together only those birds who carry their tails at the more graceful angle of forty-five degrees. And so on and so on, through all kinds of variations, Mr. Foxall showed that he was familiar with all the intricate branches of the subject, and, what is more, he gave the Society some useful tips in breeding. But he advised the man who did not thoroughly understand the subject to shun fowl-farming like the plague.

One point where man can improve on nature much to man's advantage was told by Mr. Foxall to a grateful audience. That

is, that to crow in the morning, the rooster must stand on tiptoe and stretch out his neck. Hence, if you do not wish your slumbers disturbed by the early bird, put his perch under a shelf too low to let him stretch himself. Then he is silent.

THURSDAY, FEBRUARY 21ST, 1907.

The Moon.

BY

DR. SPITTA, F.R.A.S., F.R.M.S.

Illustrated with Lantern Slides.

THE lecturer commenced by saying it was difficult to decide which was the more awe inspiring—the study of the marvellously minute or the consideration of the gigantically great ? On a previous occasion he had the pleasure of dwelling upon the microscope and its wonderful revelations of things that were small ; to-night he hoped to direct the attention of his audience to things that were gigantically great.

If the Moon were suddenly struck out of existence, what would happen ? There would be a wail of woe from all the tidal harbours in the world, for the vessels without could not get in and those within could not get out. Commerce in consequence would be at a standstill. So the Moon might be said to be of commercial interest as well as a great friend to the poet and painter.

The lecturer then proceeded to illustrate by slides and verbal explanation the origin of the Moon, how it was "cast off" from the Earth in very early times owing to its terrific revolution on its axis—turning once in three hours instead of having a day and night in twenty-four. The Moon was flung off and for the same reasons that the drops fly from a mop that is rapidly spun round or a stone leaves the sling.

How the Moon increased its distance till it arrived at its present one and how such is measured by the astronomer were then very carefully gone into, the lecturer saying he felt that after what he had said he felt quite certain all his audience would be able to go home and do it at once.

The phases of the Moon were shown by diagrams first, but afterwards by the use of a large white ball, which was illuminated by a stage lime-light, so as to enable those present to grasp thoroughly the causes that led up to the quarter Moon, full Moon and the waning Moon.

The absence of air on the surface of the Moon, the force of gravity on the Moon—6lbs. on the Earth only weighing 1lb. on the Moon—how the Moon was weighed and the terrific heat and the terrific cold experienced by the surface were all liberally touched upon, and the consequences of such fully discussed.

The rate our luminary travelled in space, viz., three thousand feet a second, and its continued falling towards the earth of about a twentieth of an inch in the same unit of time, were then spoken about, and the reason afforded why, though it kept falling at this rate, still it never came upon us from above: an apparent paradox, though one capable of very easy explanation to those who gave a few minutes' attention to the subject.

The structure of the surface and the superficial appearances of the Moon were then spoken about, and a series of photographs exhibited, some of which were taken by telescopes of quite recent manufacture, which showed what an improvement had been effected in modern times in comparison with the very first photograph ever taken of our luminary, which the lecturer was able to show them on the screen. Numerous details of mountain structure were also illustrated by the lantern, a large collection of slides being employed, and, what made the matter of great interest, the actual number of miles across was supplied in several instances, one in particular being exactly that of London to Brighton. How these mountains were supposed to have been formed in early days was not the least interesting part of the lecture, for it brought home to the audience what gigantically great eruptions must have taken place in those prehistoric times.

After mentioning the part played by the Moon in Eclipses, and the explaining of the difference between an eclipse of the Sun and the Moon, the lecturer concluded by showing a mechanical slide invented by Professor Shackleton, which provided his audience with the representation of a *real* eclipse of the Sun, which he said he was able to do at much less expense than going to remote parts of the Earth to witness, and with far less fatigue.

THURSDAY, MARCH 21ST, 1907.

Common Parasites of Cat and Dog.

BY

MR. G. H. LIVESEY, M.R.C.V.S.,

Illustrated by Specimen Lantern Slides.

PDARASITES. What is a parasite? Not merely one animal living upon another. Because a fox lives upon rabbits and poultry he is not therefore a parasite! One animal is only said to be a parasite upon another when the size of the consumer is small or even inconsiderable when compared with that of its victim. As a rule, animals of a lower order are more often parasitic upon those of a higher order, and not the higher upon the lower.

But every small animal found upon a larger one is not necessarily a true parasite. Thus there is mutualism where two animals may live together and benefit result to both; commensalism where only one finds benefit, but no injury results to the host which acts as a harbour of refuge or supplies most favourable conditions of existence; true parasitism where again only one of the two benefits, but it benefits to the extent of shelter and sustenance *at the expense and to the detriment* of its host.

Parasitism is very common throughout the natural world, and we see it on all sides, and the study of parasitology is elucidating many facts concerning disease. I need only mention the comparatively new science of bacteriology to remind you how science has developed during the last few years, and proved that many conditions, which we call disease both in man and animals, do not arise, as had been believed for scores of years, from purely physical causes but from the presence of minute vegetable organisms, bacteria or more commonly called microbes. Also let me remind you how such diseases as malaria, supposed at one time to be due to bad climate, is now proved to be due to minute animal parasites in the blood, having been inoculated into the system by the bite of the mosquito.

I am not going to speak of these minute parasites to-night, but will confine my attention to those which hold higher places in the natural orders, and of course I only want to draw your attention to *a few* of those parasites which are commonly to be found upon dogs and cats in this country. The number is very large for these animals, and the dog especially makes an excellent host and pays dearly for the privilege. By this statement I

hope you will not think that I mean the dog is so full of parasites that he is not a fit companion to man. Such an idea is foolish.

ANTHROPODA. INSECTA.

Pulex Serraticeps. Life History. Belongs to the order Insecta and the order Aphaniptera (no wings), which is properly a suborder of the Diptera or two-winged insects. They have two serrated mandibles used as prickers, two jaws or maxillæ and a single rigid tongue. Rudimentary wings in the form of plates, size 1-4 m.m.; remarkable power of jumping. Live on mammals and birds and pass from one host to another, female lays about twenty eggs in dusty corners of houses, or on any dust heap. Eggs hatch in about a week to a thirteen segmented larva with no legs, but having bristles. In ten days to a fortnight the larva spins a cocoon. From this emerges the young flea, which in another fortnight after changing in colour from white to brown becomes a perfect insect and at once proceeds in quest of a new host to torment.

Nourishment by sucking blood. Distinctive marks. Species.

Lice. *Pediculi.* Dog has two, cat one.

Haematopinus piliferus, or true dog louse, 1-2 m.m. long, varies in colour from white to brown or purple. It buries head in the skin and sucks blood and causes a great deal of itching in most animals, but not so much so in dogs. Seen most on the shoulders, throat, lips and ears, especially in sporting dogs. Female lays a large number of eggs or nits, which are glued to the hair. Third generation from one female in two months may reach as many as 125,000 young lice!

Trichodectes latus, or broad-headed dog louse, does not suck blood but devours the scurf and skin and causes only very little irritation. They are very small and often escape observation. They are very interesting in connection with the tapeworms.

CLASS : ARACHNIDA.

Order : *Acarnia.* These give rise to a disease of the host named Acariasis. Some of the families of this order are merely casual visitors, some eat the skin debris and hair and some are blood suckers. Many only cause slight trouble and the disease does not extend beyond the point of attack, whilst others, by rapidly increasing in numbers, by biting many times and by the poison they carry into the skin, their burrows in the skin and the intense irritation they set up cause a serious state of disease which is called scabies, or more commonly mange. One of the more simple (or non-psoric) Acariasis is that of the

(a) Ixodidae or Ticks (wood mites). The common dog tick or *Ixodes ricinus*. They have been recognised for many hundreds of years, and Aristotle speaks of them as *Kunoraistes* or dog

tormentors. They frequent woody places and hang from plants ready to attach themselves to any animal that may chance to pass. Taking a firm hold with the legs the insect implants the rostrum into the skin, where it remains firmly held in place by the retrograde teeth. So firm is it that if one tries to pull the insect off the head will be broken off and remain in the wound. The female gorges herself with blood, often swelling to ten times her normal size (sometimes as big as an olive). When satiated she withdraws her rostrum and falls to the ground, where under a stone or bit of wood she lays a heap of eggs and then dies. Hatching lasts from 15 to 20 days. The male is brown, the female orange coloured, except when full of blood, when she becomes purplish. These insects have a special breathing plate behind the last two legs.

(b) The next family, *Trombidüdae*, furnishes one parasite of special interest, *Trombidium holosericeum*, or red mite, or harvest bug. The mature insect lives on grass land and in woods. The female lays her eggs in July, and the larva which emerges will attach itself to any mammal. Moles and rabbits suffer most, but many dogs and many men suffer also, and cats are even attacked. The specimens shown were taken from my own dog after she had been playing in the garden. They set up a terrible itching by implanting the rostrum in the skin and sucking. The insect is a bright orange red, and when first seen is about the size of the eye of a small needle. The completion of its development does not take place on its host, whom it leaves when satiated.

(c) *Sarcoptidae*. This is one of the most important families and is the one which furnishes us with the cause of true mange. This was named by the Greeks *psora* or itch, and by the Romans *scabies* (from *scabere*, to scratch), and is known in England by many names, such as itch, scald, yuek, and mange. Its history is common both to man and animals. In Leviticus we read that that most expert sanitarian and M.O.H., Moses, excluded mangy animals from sacrifice as unclean. In Hannibal's campaign against the Gauls both men and horses suffered from it. But its nature was first discovered by an Arab physician, Avenzoar, who lived in the 12th Century. The insect was only determined finally to be a sarcopt in 1834 by a Corsican, Renneir.

Some idea of the power the disease has of spreading is formed when it is seen that each female lays about fifteen eggs—ten female and five male. These in fifteen days are mature and begin to reproduce their species, so that at this rate from one single female in 90 days (about three months) may be produced 1,000,000 females and 500,000 males!

The Sarcoptidae are sub-divided into Sarcoptes, Peoroptes, and Symbiotes, and of each there are many varieties.

Only the Sarcoptes and the Symbiotes are commonly found on dogs and cats.

- (a) Sarcoptes. In man, in dogs, in cats (in the skin).
- (b) Symbiotes (Chorioptes). In the ear only.
- (d) Demodex. Follicular mange.

Life history of each was described.

VERMES.

The worms of the dog may be divided into two classes—round and flat.

Round worms or NEMATODES.

Ascaris Marginata and *Ascaris Mystac* (of cat). In stomach and bowel.

Anchylostomum Trigonocéphalum. In the small intestine.
Trichocephalus Depressinsculus. In the coecum.

Spiroptera Sanguinolenta. In tumours of the stomach and liver.

Eustrongylus Gigas. In the kidney.

Strongylus Vasorum and *Spusillus*. In the heart and blood vessels.

Filarice immitis. In the heart and blood vessels.

Life history of each was shortly described.

VERMES. CESTODES.

		Intermediate host and habitat.
Dog	T. <i>Serrata</i> , about 8ft., 34 to 38 hooks in two rows.	Cyst. <i>pisiformis</i> . Hares and wild rabbits.
	T. <i>Marginata</i> , 2 yards, 80 to 44 hooks, segments short and broad.	Cyst. <i>Tennicollis</i> . Various parts of oxen.
	T. <i>Coenurus</i> , 2-8ft., 22 to 32 hooks	<i>Coenurus Cerebralis</i> . Brain of sheep.
	T. <i>Echinococcus</i> , 5 m.m., 28 to 50, 3 segments.	<i>Echinococcus Veterinorum</i> . Livers of ox and man.
	T. <i>Canina</i> (<i>dipylidium canium</i>), 5-25in., 4 rows hooks, 2 pores.	<i>Cryptotrichodectis</i> . Dog louse and flea.
Cat	T. <i>Crassicollis</i> , 20in., 34.	Cyst. <i>fasciolaris</i> . Livers of rats and mice.

A short life history of each was given.

These worms are peculiar in not being able to complete their existence in one host. The chance of an egg becoming a mature worm is almost infinitesimal, although one worm may produce considerably over a million eggs in less than a year.

Each egg in order to develop must be taken into the system of an intermediate host of a definite species, there to develop partly and lie quiescent until its host becomes a prey to the dog, when its development may be completed. The fact that the intermediate or cystic stage is passed in many animals used for human food should be sufficient warning to us to see that the meat inspection of our cities is rigidly carried out by really competent persons.

THURSDAY, APRIL 18TH, 1907.

Earthquakes.

BY

MR. F. R. HORA, B.A., B.Sc.

THE lecturer, in opening his address, stated candidly that he could not offer the Society any researches of his own on the important subject of earthquakes, but as he was addressing a distinctly cultured audience he proposed treating it from a scientific rather than a popular point of view. As regards the historical side, he stated that the earliest records of earthquakes were to be found in our Bible, and read passages wherein earthquakes were mentioned, such as Moses receiving the law on Sinai, the story of Korah, Dathan and Abiram, the fall of Jericho, the terrible earthquake in the reign of Uzziah King of Judah, and also the scene during Christ's crucifixion. The old Greek and Latin writers often alluded to the phenomenon and even put forward probable theories to explain it, but the modern and systematic study of the subject started about the beginning of the Nineteenth Century and is connected with the names of Professor Alexis Perrey, of Dijon, Mr. Robert Mallet and his son, and Professor Milne in England, and Major Dutton and Professor See in United States, and great results followed from the work of the Seismological Society of Japan, established in 1880.

A slide was then projected on the screen giving Mallet and Milne's definition of an earthquake as follows:—An earthquake is the transit of a wave or waves of elastic compression or elastic contortion in any direction from vertically upwards to

horizontally, in any azimuth, through the crust and surface of the earth, from any centre of impulse, or from more than one, and which may be attended with sound and tidal waves, dependent upon the impulse and upon circumstances of position as to land and sea. This definition was illustrated by a diagrammatic representation of the path of a typical earthquake, and underneath was given a glossary of the more important terms connected with earthquake study, as follows :—(1) *Seism*—an earthquake ; (2) *Seismology*—the science of earthquakes ; (3) *Seismometers*—instruments to measure the extent of the horizontal and vertical components of an earthquake ; (4) *Seismograph*—record of an earthquake motion traced out by a style on a moving smoked plate or by a spot of light on a moving roll of sensitive paper ; (5) *Seismologues*—catalogues giving details of all recorded earthquakes ; (6) *Centrum, Focal Cairy or Origin*—positions in earth's crust from which the elastic waves started ; (7) *Epicentrum*—point vertically above centrum ; (8) *Seismic Vertical*—line joining origin and epicentrum ; (9) *Wave Paths*—lines radiating from focus ; (10) *Angle of Emergence*—angle made by wave path and the horizon ; (11) *Isoseismic or Coseismic lines*—lines of equal mechanical effect, theoretically they would be circles in a homogeneous medium, in reality they are irregular curves ; (12) *Meizoseismic Area*—area of maximum destruction ; (18) *Bradyseism*—slow secular upheavals of earth.

The next slide showed the earliest Seismometer, viz., Choko's, a Chinese invention of A.D. 186,—really a pendulum instrument, arranged so that the swinging of a pendulum would cause a ball to move in a definite direction through a dragon's mouth into that of an expectant frog's, who gratefully acknowledged the receipt of the ball by wagging his head up and down for some minutes. Another slide gave diagrammatic representations of the pendulum types of Seismometers,—(1) the long simple pendulum ; (2) the duplex pendulum, as used by Mr. Gray and Professor Ewing ; (3) the horizontal component recorder ; (4) the vertical component recorder ; (5) Darwin's bifilar pendulum with moving spot of light ; and, lastly, Professor Milne's perpetual Seismometer and recorder.

Mr. Hora then discussed the premonitory symptoms of earthquakes, such as physiological effects on birds and animals, effects on springs, and the sea, subterranean noise, &c., and stated that though such symptoms of coming seismic activity were exceedingly vague, yet well authenticated prognostications were recorded. The effects of a typical earthquake were then detailed—the minute vibrations of a period of 1-5th to 1-20th of a second, the shock itself with a period of one or two or more seconds, and the after shocks ; moreover, the lecturer remarked that the vibrations were generally performed in different azimuths, there being a twisting movement as well as a vertical and

horizontal one ; also, the number of shocks in one locality varied enormously, 1,000 shocks a day have been recorded, whilst Calabria was affected by shocks for ten years after the great earthquake of 1783. The amplitude of vibration in a horizontal direction varied from a fraction of a millimetre to about 70 mms. (three inches), the vertical amplitude being much less, never more than 10 mms. The velocity of the earthquake wave depended on the strata through which it travelled and the intensity of the shock and the distance from the origin, varying from a few hundreds to several thousand feet per second. The lecturer remarked that the characteristic sound which often accompanied an earthquake might be due to the folding and contortion of strata or by the rapid vibrations of the earth's surface being communicated to the air and air waves being formed.

The effect of earthquakes on land and sea were then described at length, such as faulting (the nature of which was explained by diagram), cracking of the earth, the overturning of buildings, the ejection of liquids and gases from fissures thus formed, the damming of rivers, and the stopping and starting of water springs, and the remarkable but terrible effects of the so-called tidal waves. Details of numerous examples to illustrate these effects were given.

Slides were then shown of earthquake effects, some illustrating cracking and even contortion effects on buildings, whilst others served to illustrate the destructive effects of recent earthquakes at San Francisco, Valparaiso, and Kingston (Jamaica). A short account was given of the numerous mythological and pseudo-scientific explanations of earthquake phenomena—such as motions of mythical monsters within the earth, also supposed chemical effects, such as sulphur being burnt, imprisoned air, &c. At the present day only two theories held the field, and of these one seemed more or less dependent on the other. Before discussing these, Mr. Hora asked the audience to carefully examine Professor Milne's map showing distribution of earthquakes in space, and he projected the map on the screen, drawing special attention to the fact that, with the exception of the Alpine and South Himalayan regions, all areas of seismic activity corresponded with modern volcanic activity, and that the 400 known volcanoes all lie within a distance of fifty miles from the sea coast, and lastly that the highest mountains as a rule faced correspondingly deep depressions in the ocean. He also drew attention to the varied nature of the ocean beds, the mountainous character of which seem to surpass that of the earth.

Of these two theories, that of the explosion of steam within the crust of the earth, generally below the ocean bed near the shore, was hinted at by Aristotle, Lucretius, and Pliny, and definitely stated by Strabo ; it is alluded to by Shakespeare, but in modern times was put forward definitely by Mr. Robert Mallet

in the early part of the nineteenth century. As evidence of the porosity of the earth's crust, Mr. Hora drew attention to the celebrated Florentine experiment of the sixteenth century, in which the water contained in a thick hollow spherical gold shell was forced through the solid by decreasing the volume of the hollow interior by changing the sphere's shape. Moreover, the lecturer remarked, still more wonderful were the experiments of D'Aubigny, who 40 years ago showed that water by capillary attraction only could be made to penetrate almost anything. Thus it could be easily understood that a constant supply of water would be passing gradually through the ocean bottom into the solid crust below, where it would be converted into super-heated steam at an enormous pressure.

The theory not only accounted satisfactorily for the remarkable coincidence of regions of volcanic activity with those of seismic activity, but it gave a very beautiful explanation of mountain formation.

The lecturer drew attention here to the modern view of the earth's interior, viz., that it was probably a solid core and a thin solid crust, but that between the crust and the core might be a thin layer of molten lava, ready to flow out on to the earth wherever there was a deep fissure or volcanic break which permitted its egress. Elie de Beaumont, about 1830, sought to explain the formation of mountains by the contraction of the earth's crust due to secular cooling—the "dried apple skin" theory as it was sometimes termed—a theory which, though it had held the field for many years and was simple to understand and apparently supported by many mechanical experiments to illustrate it, yet seemed likely to be abandoned, after the destructive criticism levelled against it by the Rev. O. K. Fisher (in his book "Physics of the Earth's Crust"), Professor Suess, Sir Archibald Geikie, and others, in favour of the idea that mountain chains have arisen from subvolcanic explosions of steam, and that during seismic activity a tangential thrust towards the land from the sea causes the lava below the crust to be forced up near the seashore, and thus a chain of mountains results. Slides were shown to illustrate this idea, and also how table lands or elevated plateaux could be explained in the same manner. Mr. Hora stated that as a corollary all mountain ranges must be of volcanic origin, and to this statement the Alps and Himalayas seemed exceptions, but it was only right to state that these are quite recent upheavals and that the original volcanic axes may be concealed and buried beneath the thick masses of the nummulitic limestone which make up these mountains.

The rival theory, originally stated about 1831 by Bous-singault, and now supported by a large band of seismologists, such as Professor Milne in England and Major Dutton in the United States, is known as the "Tectonic" theory and supposes

that seismic activity was due to faulting of strata chiefly in regions where recent secular upheavals have occurred and where the gradients are very steep (so-called "monoclinal folding"). The supporters of this theory state that steam explosions may cause some (but only a few) of the milder earthquakes, but that it is inconceivable that such tremendous effects and these spread over such large areas could be produced by the agency of subterranean steam only. Mr. Hora thought that the weakness of this latter theory consisted in the fact that faulting and dislocations of strata seemed symptoms only of some still more mighty forces at work within the earth's crust, and such forces its supporters maintained were due to secular contraction—a theory which, as stated above, was hardly tenable in the light of modern researches.

The lecture was concluded by a few remarks on submarine volcanoes and bradyseismic movements. As regards the former a slide was shown of a typical submarine eruption as it appeared at sea, and the lecturer remarked that they were very common indeed, almost as common as terrestrial eruptions. He then showed a slide of the remarkable island which rose from the Mediterranean Sea in 1831 and remained in existence only three weeks,—it was known as "Graham's Island," and evidently resulted from a submarine eruption. To illustrate bradyseismic movements, Mr. Hora showed a woodcut of the celebrated remains of the temple of "Jupiter Serapis" on the coast of Italy, and explained that there must have been at least five alternate subsidences and elevations within the last 2,000 years.

Darwin's coral reef theory afforded a splendid example of slow subsidence of the ocean bed, and a slide was shown to illustrate the three stages of a coral reef's evolution. Having explained that corals could only live in salt water at a temperature never below 68° F., nor at a depth greater than 90ft. from the sea surface, the question arose—"How came it that numerous coral islands lie studded in groups in all the great oceans, especially the South Pacific?" Darwin suggested that a "fringing" reef was first formed near some island and this by subsidence was converted into a "barrier" reef, and when the island disappeared altogether by further subsidence an "atoll" or ring of coral only remained, hence the atoll was the tombstone of a departed island. This theory, despite the attacks made upon it by Agassiz, Sir John Murray, and other naturalists, had been verified by borings made recently at Funafuti, and although there was evidence now that some coral reefs had arisen by deposition on submarine volcanoes or on shore platforms or submarine flats formed by the erosion of pre-existing land surfaces, and not by subsidence, still a large number of them certainly came into existence in the way that Darwin had suggested.

THURSDAY, MAY 16TH, 1907.

EXTRACT OF A PAPER ON
**Pigmy Flint Implements Found near
Brighton.**

BY
MR. H. S. TOMS.

FIVE years ago I had the pleasure of reading to this Society a paper on "Some Prehistoric Camping Grounds near Brighton," and, as that paper was stated to be but a preliminary report of my local investigations, it may be thought that I am about to occupy you with a further instalment of the same subject. Let me assure you that this is far from my intentions. I may say, though, that I and my friends have paid considerable attention to our local camping grounds since the reading of my paper, and, as we are being constantly rewarded with interesting discoveries and new material, the period for the presentation of anything like a final report to this Society gets more hazy every day. In many respects it seems fortunate that we are thus unable to trouble you with anything but preliminary or imperfect reports on our periodic discoveries.

During the course of the evening brief allusion to the local camping grounds will be made; but my present subject has to do with discoveries markedly different to those brought before you on the last occasion. "Pigmy Flint Implements found near Brighton" is the subject for this evening, and the first thing I have to say in connection with them is that the word "Pigmy" is applied, not to the prehistoric people who made and used them, but to the implements themselves. When you are told that some of these little tools are so small that 64 taken together weigh less than half an ounce, I think you will agree that they thoroughly deserve their name.

In the foregoing slides we have seen the simple artificial chip and the various kinds of flake instruments commonly found with the larger stone tools and human remains of prehistoric man in many parts of the world, and their use has been made pretty clear owing to the same types having continued to be made by savage tribes down to the present day.

From the Associated "Find" near Brighton.

TYPICAL CORES.

THE FLINT AXE OR ADZE.

TYPICAL PIIMIES.

SELECTED FLAKES.

(Scale shown, Three Inches.)

The remarkable pigmy implements which I am about to describe have not such a world-wide distribution. With possibly one exception they have not been found associated with human remains or with the ordinary large stone tools of prehistoric man. Again, no modern savage uses anything like them, so we are left to conjecture the purposes for which they were made.

Having said this much, let us have a look at a comparative series of the pygmies. I repeat they are not found the world over. So far, they have only been recorded from the Vindhya Hills, India, and a few places in Palestine, Egypt, North Africa, Spain, France, and Belgium. In England also their localities are not numerous, the principal being in East Lancashire, Lincolnshire, and Sussex. Though the spots where they are found are few, it is encouraging to note that, wherever discovered, they exist in large numbers.

Of the specimens before us, the first thing I have to draw attention to is their size. The smallest in the top row is $\frac{1}{4}$ in. long, the largest, in the bottom row, does not exceed $\frac{7}{8}$ of an inch. All are made from artificial flakes and each specimen has one of its edges covered with secondary chipping, thus showing they were intended for some special purpose. The first row is from Scunthorpe in Lincolnshire, the middle Indian, and the bottom from Lakenheath in Suffolk. The remarkable point about them is that the implements from various places are so much alike in shape and size that, if a representative series were placed in a box and shaken up, it would be an impossible task to reclassify them according to locality.

The Indian varieties were found in the caves and rock shelters among the Vindhya Hills in places difficult of access and unknown to the ordinary traveller. Some were found in the alluvium at the mouth of the caves, where they had been washed out and were caught in the ledges of the rock. Within the caves they were found in the uppermost strata, while, immediately beneath, but separated from them, were larger implements, different in size, kind and style. Crescent-shaped pigmy implements were found in the grave mounds of the neighbourhood of the caves, leading one to suppose that the inhabitants of the caves, who made these implements, built the mounds and here buried their dead.*

This shows us a typical series of the Vindhya Hills "find." In 1, 2, 3 rows are the various forms of the pigmy tools, in 4 the long symmetrical simple flakes, in 5 the rough flakes. Rows 4 and 5 are examples of the waste flakes struck off in obtaining forms suitable for conversion into pygmies, and in row 6 are the cores from which the chips were made. The latter are extremely small, and the next slide shows us six of these which are in the Brighton Museum.

Here we see the same forms of minute tools found in Central and Southern France.

With few exceptions the English pygmies have been found confined to patches of sandy ground from 30 acres in extent down to 100 square yards ; and, owing to their being discovered on the surface and unaccompanied by any of the larger tools typical either of Early or Late Stone Age man, it has been found impossible to determine with certainty the true position they occupy in the prehistoric periods of the countries to which they belong. It is true that a few large examples of the same type have been found in the French caverns with the remains of palæolithic man, but recent discoveries seem to indicate that the true pygmies were made in the Later Stone Age or Neolithic period.

As the question of the uses to which these small tools were put is still open, one cannot pass it by without taking a personal "pot-shot." Many probable suggestions have been brought forward in answer to this query. It is thought they may have been used for tattooing, as barbs for arrows or harpoons, as fishhooks, etc. Many of the larger specimens would have made most excellent arrowpoints, and that the same forms were so used in late palæolithic times we have unmistakable evidence in this slide.* This shows us two lumbar vertebrae of a young reindeer found in the Grotto of Les Eyzies, Dordogne, France. Both are pierced with one of these flint points, thus showing that the animal was shot in the back by the cave men, who kindly left the arrow points *in situ* so that we might have something to enlighten us in these studious days.

The most interesting discovery of flint implements yet recorded from Sussex is that made by Mr. W. J. Lewis Abbott on the rock ledges in front of the cliff caves at Hastings. Our next slide shews the excavation of what is presumed to be an ancient refuse heap situated on the rock ledge just under the mouth of one of the Hastings caves. Here it was that Mr. Lewis Abbott found a large number of the various types of pygmy flint instruments. Associated with them were hundreds of flint flakes, cores, hollow scrapers, cooking-stones, pottery, and the bones of the shorthorn ox, pig, horse, sheep, goat, dog, wolf, fox, hare, rabbit, badger, birds, fishes and shells.

Here are shown some of the Hastings finds. First we have the pygmies, some of which have been mounted by Mr. Abbott to show what they might have been used for ; drilled bones, probably used as ornaments ; and a flint core, showing us how prehistoric man failed in his attempt to get off a flake which would have made an admirable pygmy tool.

* *La Gaule avant les Gaulois*, par. M. Alexandre Bertrand, 1891.
p. 97, figs. 76 and 77.

Mr. Lewis Abbott says that "One or two fragments of bone showed signs of carving. One was a well-made stiletto, another a portion of a needle. The most interesting circumstance connected with the bones was that the flint wedges were found *in situ* in the bones, as they were used for splitting them. (One of these is shown on the screen.) The whole of the marrow bones were thus split for marrow and the skulls for brains; and even bones which contain no marrow were often similarly reduced, possibly for either boiling to extract grease or for use in making bone tools."*

No large tools, such as the flint axe, were found with the pygmies at Hastings.

Pygmy implements have also been found at Fairlight by Mr. Ruskin Butterfield, at Pulborough by Mr. Garraway Rice, F.S.A., and at four places near Horsham by Messrs. C. J. Attree and E. J. G. Piffard. Compared with the other finds in England, Sussex has therefore proved very rich in this interesting group of diminutive flint tools.

Now let me give you the history of my discovery of pygmy flint instruments near Brighton. A year or two ago I was particularly interested in that class of neolithic tool known as hollow scrapers. These, which I fully explained in my last paper, are artificial chips of flint, with little notches chipped out of their sides, used for scraping objects of wood or bone, such as the shafts of arrows or bone needles. At the time of which I speak I had occasion to visit a sandpit near Brighton in connection with the discovery of antiquities other than stone tools. But, having let my mind run riot on hollow scrapers, even the discovery of more important remains did not prevent me from keeping a sharp look out for them whenever I happened to be in a likely locality. .

The sand pit alluded to has a capping of clayey mould on an average about 2ft. deep. In order that this mould shall not mix with the sand, it is removed in large patches by the workman and the top of the deep bed of sand is thus exposed. I cannot show you a slide or give you a detailed description of the sand-pit, otherwise the secret which I am unfortunately compelled to keep will be mine no longer. Let me therefore say that, in walking over the top of the sand from which the surface mould had been removed, I picked up a very small hollow scraper and several unworked flint chips. These gave me the clue to a new site, and when visiting the spot again I found other minute flint chips, including one, very like a tiny knife blade, with beautiful secondary working all the way down the thick edge and on the two ends of the sharp edge as well. It was quite unlike anything

* "Primeval Refuse Heaps at Hastings," by W. J. Lewis Abbott, F.G.S.; *Natural Science*, August, 1897, p. 95.

I had found before. Shortly after, when sending some things to the British Museum, I enclosed this minute tool together with the hollow scraper, asking that they should be shown to Mr. Read for his opinion as to whether they were pigmy implements. The answer was that Mr. Read considers them true pygmies. Therefore, knowing that wherever pigmy implements occurred they were generally to be found in large numbers, you may imagine that my zeal for the ordinary hollow scraper was suddenly eclipsed and that it was not long before I was again in that sand pit assiduously hunting for this new kind of minute tools. Several were turned up at each visit, and I found they occurred over the whole area of the rising ground where the sand had been exposed, that is to say, in a space about 200 by 50 yards. But an enthusiastic member of our Archæological Club has, quite independently of me, still further extended this area, and we now know that the pygmies occur along the rise of the land for a distance of nearly a 1,000 yards. In this respect the site agrees with the finds made in other parts of England, where the productive areas range from 30 acres in extent down to 100 square yards.

Such was the origin of my discovery of pygmies near Brighton. Ever since I and one or two friends have followed it up with the utmost enthusiasm. Not content with looking over the top of the sand and the heaps of refuse mould, I closely examined the sides of the sandpit to discover, if possible, some of the pygmies *in situ*. In this, too, I met with success, for several were pulled out about 18in. deep in the capping of the mould, whilst others were found protruding lower down at the point where the mould and sand meet. Flakes were also met with at the same levels.

Having ascertained this much, the mode of procedure next introduced was the poking of the sandpit's sides with the end of one's walking stick. This, too, was surprisingly successful, for at one point in the side of the old roadway leading into the sandpit the walking stick exposed a layer of artificial flint chips about 2ft. 6in. from the surface and a little below the level of the top of the sand.

Investigation with hands and walking stick was energetically pursued, and the result of this prehistoric method of excavation was beyond one's most ardent hopes. Handful after handful of the flakes were pulled out, and it was observed that they were lying on the bottom of a small basin-shaped pit scooped out of the mould down into the sand beneath. This slide shews a typical selection of the best flakes.

Soon after operations were commenced a "pigmy" was pulled out with a handful of these flakes; then came the cores from which the flakes were struck; burnt flints used in primitive cooking; then more pygmies; scrapers; hollow scrapers; now

something fairly large, namely, a flint axe of purely neolithic type, which, I think I am correct in stating, has never before been found in actual or indisputable association with pigmy flint implements.

When the spoils were brought home and laid out it was found that as many as seventy pygmies had been turned out from the bottom of this shallow hole. A representative series is shown on the screen. These are the scrapers found. One is broken by fire. In form they are long or spatulate, and the same type occurred with the Hastings find.

Nearly 2,000 flakes came out of the hole, and the interest of these was considerably enhanced by the discovery of about thirty flint nodules or cores from which the flakes were obtained. This slide shows us three examples of the cores, and the centre one tells the same tale as the Hastings core, namely, how the prehistoric workman sometimes failed in getting off the flake he desired for conversion into a pigmy instrument.

From the hole or pit, which was about six feet in diameter, no trace of bones was turned out, neither was any pottery found, so, in these respects, the "find" differed from that of Hastings.

What then is the story which the contents of this small pit have to tell? This question opens up a wide field for the imagination, and, I must admit, that it cannot be fully answered in the present stage of our knowledge of early man; for, instead of simplifying matters, these discoveries show how complex are the problems connected with the study of prehistoric remains.

Briefly put, the fragmentary story revealed by the discovery near Brighton is as follows: —

The existence of the minute implements, together with artificial chips and cores over such a wide area, which is situated some distance away from the Downs on the Weald, plainly indicates that this spot possessed certain features which were of advantage to prehistoric man. Here he brought flint nodules in order to produce chips from which to form these tiny implements. The fact that the latter occur in such numbers seems to prove they were used on the spot and then discarded. The discovery with the flakes and pygmies of flints showing traces of having been in or pretty close to a fire tells us another fragment of the story. These, as I explained in my last paper, were used in primitive cooking operations, and we may thus regard the whole area as having been, at some prehistoric time, a settlement or camping ground of the Britons of the Weald.

The discoveries in the pit supply remarkable confirmation of this. Over this hole, which he dug down through the stiff mould into the sand, the Ancient Briton probably erected some sort of tent, in order to supply shelter from inclement weather or from the rays of the sun. Afterwards it served as his

workshop, and the objects, which form the subject of our entertainment this evening, were the things he left behind. Many of the pigmies, flakes, cores, etc., so found show undoubted signs of proximity to fire ; so, if these marks were not produced by cooking operations within the pit, the alternative inference is that some prehistoric wag must have burnt the occupant out of house and home.

The existence of this pit and its interesting remains very strongly suggests that the whole settlement was originally covered with similar holes dug down into the sand, and that the pigmies, flakes, etc., found over the disturbed area were originally *in situ* in such pits. It seems a pity that their destruction by the extraction of sand should have been going on for nearly twenty years without any observations having been made. But, as the most likely spots are yet untouched, I am hoping that precautions will be taken to ensure the proper supervision necessary for the preservation and recording of " finds " similar to mine.

The importance of the find before us is of no small order. As an undoubted associated discovery it will be of the utmost value in the comparative study of the other Sussex pigmies. I have already stated that nearly all the English pigmies occur on the surface of settlements, and this fact renders the period to which they belong highly problematic. Although this period has been roughly fixed as not earlier than late neolithic times, none of the larger implements characteristic of this period has hitherto been found with the pigmies. Therefore the discovery of the purely neolithic axe or adze with the other objects in the pit is, probably, the most important piece of evidence with regard to the period of the pigmies yet brought to light.

In conclusion brief reference has to be made to the style of workmanship displayed in the fabrication of the pigmies. The rough cores and the large number of unworked chips found in the pit supplies good evidence that, in obtaining a flake suitable for conversion into a pigmy, the ancient Briton had the same difficulties to contend with as the Australian savage has in the manufacture of his stone knives. If we divide the flakes found in the pit by the number of pigmies, we ascertain that 20 to 30 flakes were struck from the cores before the desired result was arrived at. This is a rough estimate, but I think it is fairly accurate. Having secured the proper kind of flake, how did he convert it into a pigmy ? I presume to say " by pressure," either with a piece of bone or with another stone, for I have made exact copies of them with both objects by this method.

The only object of the prehistoric chipper's paraphernalia which I did not find in the pit was his flint hammer which he used in chipping the cores ; but I think we have here (nodule) the instrument he used in pressing off the minute secondary

flakes when making the pigmies. Several of these nodules with worn edges were found by Mr. Lewis Abbott at Hastings, and he is in agreement with me as to the purpose for which they were used.

The highest stage attained by prehistoric man in the art of flint chipping is exemplified in the inimitable examples of arrowheads and knives, shewn in our first few slides, the workmanship of which was undoubtedly accomplished by the difficult method of punch and hammerstone flaking. So far, I believe, none of this beautiful work has been found actually associated with the pigmies,* and, as they were all shaped by the comparatively easy method of pressure flaking, we cannot regard them as evidence of a very high standard of flint chipping. This point deserves special attention, for, provided no traces of the highest class of flaking are found with future discoveries, it will afford additional grounds for believing that this class of minute tools was made by a race, or tribes, quite distinct from the prehistoric Britons with whose remains we find the beautifully worked arrowheads along the Downs of Sussex.

May I hope that my remarks have served to demonstrate that which cannot be too earnestly impressed upon all who have the advance of knowledge at heart, namely, that the archæological harvest in these parts, at one time truly plenteous, has been scattered by the winds of ignorance and apathy. About this wonderful County of ours patches of the grain still lie concealed, but the gleaners are few. If further destruction is to be arrested, if this material is to be gathered so that we may piece together and read aright the marvellous story of our prehistoric forerunners, then more gleaners are necessary, more enthusiasm must be shewn ; and, what is all-important, the work of discovery and recording must be carried out, not by antiquated methods, but in a co-operative spirit and by rigid adherence to scientific rules.

The Brighton and Hove Natural History Society has long played an important part in the intellectual development of the County, and it is with the knowledge that its Members are ever willing to exert their influence in the noble cause of local archæology that I have ventured to trouble you again this evening.

* Note.—A very small barbed arrowhead covered with beautiful secondary chipping has recently been found by Mrs. E. J. G. Piffard, on one of the pigmy sites, near Horsham.

THURSDAY, JUNE 6TH, 1907.

Annual General Meeting.

REPORT OF THE COUNCIL

FOR THE YEAR ENDING JUNE 6TH, 1907.

The Council have pleasure in reporting that during the year now past, the 53rd year of the Society's existence, the Society has fully maintained its position and successfully carried out the objects with which on the 1st September, 1854, it was founded.

Eight Lectures and Papers have been given and read during the Session, all having been illustrated with Lantern Slides. Two of the Meetings were held at Hove, the remainder in Brighton. The attendance at these Meetings on the whole has been good.

The financial position of the Society is satisfactory, there being a balance in the hands of the Treasurer of £22 2s. 8d., in addition to which there is a sum of £100 Consols invested on behalf of the Society.

There are now 140 Members of the Society, comprising two Life Members, 19 Lady Members, 108 other ordinary Members, and 11 Honorary Members. This number differs but little from the number of Members at the commencement of the Session, the losses by death and resignation being equalled by the accession of new Members.

The Council regret to have to record a loss to the Society by the death during the year of Mr. J. W. Nias, who for many years rendered it service in the capacity of one of the Honorary Auditors; and also by the death of Mr. W. Seymour Burrows, a Past President and Vice-President of the Society. The death of such distinguished authority on British mosses as Mr. W. Mitten, who was an Honorary Member of the Society for many years, must not pass without an expression of the Society's regret.

Mr. Isaac Wells, an old Member of the Society, has consented to act with Mr. A. F. Graves, in future, as Honorary Auditor.

The Council desire to record in this Report the fact that Alderman John Colbatch Clark, J.P., is now entering upon his fiftieth year of office as Honorary Secretary of the Society, a circumstance which is very rare, if not unprecedented in the history of any Society. Mr. Colbatch Clark became a Member of the Society on the 14th August, 1856, and commenced to officiate as Honorary Secretary during the Session 1857-1858, and the Council feel that the Society owes in a very large measure its present position to the assiduous attention he has always given to its interests, coupled with the business ability, tact and courtesy he has always shown in connection with the fulfilment of his duties as Honorary Secretary.

The following are the titles of the papers contributed during the past Session :—

- | | | |
|-------------------|---|-----------------------------------|
| 15th Nov., 1906. | "Forest Life." | By Mr. MARTIN DUNCAN. |
| 20th Nov., 1906. | "Kalahari Desert and Wgamiland." | By Mr. H. WIENHOLDT HODSON. |
| 10th Dec., 1906. | "The Making of Scenery." | By Mr. H. EDMONDS, B.Sc. |
| 17th Jan., 1907. | "The Variation in Domestic Fowls." | By Mr. GEORGE FOXALL. |
| 21st Feb., 1907. | "The Moon." | By Dr. SPITTA, F.R.A.S., F.R.M.S. |
| 21st Mar., 1907. | "Common Parasites of Cat and Dog." | By Mr G. H. LIVESAY, M.R.C.V.S. |
| 18th April, 1907. | "Earthquakes." | By Mr. F. R. HORA, B.A., B.Sc. |
| 16th May, 1907. | "Pigmy Flint Implements Found Near Brighton." | By Mr. H. S. TOMS. |

The following is a list of the Excursions and Visits to places of interest during the past year, viz. :—

- | | |
|-------------------|--|
| 23rd June, 1906. | Firle Park. |
| 21st July, 1906. | Goring—Highdown Hill—Miller's Tomb. |
| 29th Aug., 1906. | Angmering—Poling—Arundel. |
| 29th Sept., 1906. | Southwick Electricity Works. |
| 22nd Nov., 1906. | Lewes—Phœnix Iron Works. |
| 4th Dec., 1906. | Preston Manor House. |
| 16th Jan., 1907. | Electrical Exhibition at the Aquarium. |

- 16th Feb. 1907. National Telephone Company's Exchange,
Brighton.
- 27th Mar., 1907. Sussex Coach and Motor Works, Brighton.
- 15th April, 1907. Warren Farm Schools, Brighton.
- 11th May, 1907. Devil's Dyke and Bramber.
- 1st June, 1907. Tilgate Forest.

Mr. Henry Davey has undertaken the arrangement of the Field Excursions during the ensuing year.

HON. LIBRARIAN'S REPORT.

JUNE 6TH, 1907.

During the past year the following serials have been purchased and added to the Library :—

Annals of Botany.	Nature.
Zoologist.	Geological Magazine.
Entomologists' Monthly Magazine.	Entomologist.
Journal of Botany.	

The publications of the Ray Society and Palaeontographical Society and the Reports and Proceedings of various other Societies with which the Society is associated have also been received.

The number of books issued out of the Library to Members has been about 70, and the general public have as heretofore taken advantage of the opportunity afforded them of using the Society's library, which now consists of upwards of 2,500 volumes, for the purposes of reference.

ROBERT MORSE,
Hon. Librarian.



MOTORS. THE MOTOR GENERATOR IS SEEN ON THE LEFT.

Society's Excursions.

SATURDAY, JULY 21st, 1906.

The members of the Society took train to Worthing and walked from there to the fine old Parish Church of Broadwater ; thence they went to the cemetery to see the tomb of Richard Jefferies. The walk along the shady road to Hightown Hill was extremely pleasant, and they found the Miller's Tomb being renovated ; the ironwork removed and the lettering being repainted. The Keltic Camp on the top of the hill was then visited and the splendid panorama of Sea and Downs much admired. Tea was taken at a cottage at the base of the hill, after which the party strolled to Goring Station, returning by train.

SATURDAY, SEPTEMBER 1st, 1906.

By the kind invitation of the President, Dr. Harrison, members were invited to visit Poling and take tea in the open air. After training to Angmering they strolled to Poling Church, thence to a farm, The Peckhams, which retains in its building some of the old work of the stables of the Knights of St. John, whose Priory, now the residence of Sir Harry Johnston, the well-known African Hunter and Explorer, is situated at a short distance. By his courtesy a visit was made to the old house, which has been recently restored by the explorer's brother, the church architect. The work has been very cleverly done and the old chapel could be traced. The curios from Africa interested the members very much. After tea the great Decoy in the neighbourhood was made a halting place on the return to Angmering station.

SATURDAY, SEPTEMBER 29TH, 1906.

This visit was to the new Electric Light Works at Southwick. A large party assembled to see the great undertaking by Brighton, and were met by Mr. Christie, the engineer, who conducted them round, carefully and clearly explaining the machinery in detail. The turbines interested the Members, perhaps, more than anything else. In thanking Mr Christie, the President expressed the satisfaction he felt at the judicious

way in which the public money had been spent. At the conclusion of the visit, Mr. Christie presented each member with a copy of the illustrated description of the works, issued in the first place for the opening ceremony by the Right Hon. John Burns.

In the engine room are three generators of 1,800 kilo-watts each, of the latest turbine-driven type. High-tension alternating three-phase current is generated by these machines at 8,000 volts, and transmitted through five trunk mains to the North Road Works, $4\frac{3}{4}$ miles away, where a large sub-station has been erected as an annexe to the old generating station. Here the high-tension alternating current is transformed down to low-tension continuous current, and is distributed for lighting, power, and traction, through the old system of mains. .

SATURDAY, OCTOBER 20TH, 1906.

FALMER WATERWORKS PUMPING MACHINERY.

Another very interesting and instructive little outing was enjoyed by the members, when, through the courtesy of the Waterworks Committee of the Brighton Town Council and Mr. J. Johnston, the Waterworks Engineer, they paid a visit to the new pumping station at Falmer. The party, numbering between 40 and 50, arrived at the works shortly after three o'clock, and were received by Mr A. Stone, the Engineer in charge of the station, who conducted them over the premises and explained the working of the machinery. The clean and neat appearance of the whole place, even the coal store and boiler house, was particularly noticeable, everything—floors, walls, engines, and boilers—were as spick and span as a man-o'-war, and the admirable order in which everything was kept was very favourably commented upon by the visitors. The party was first shewn the engine-house, with its two sets of inverted triple-expansion direct-acting steam engines (only one of which was at work), which drive the six deep well pumps which raise the water from the two wells and deliver it into the large reservoir outside, whence it is sent by the six force pumps into the mains to the various reservoirs in Brighton.

A very ingenious little engine, called a "barring engine," for setting in motion the huge flywheel of each set of pumps was shewn at work and the Westinghouse air-charger for filling the great air vessels used to equalize the pressure in the mains, the auxiliary feed pump, which also works the travelling overhead crane, and the electric recorder shewing the depth of water in

the reservoir outside, were inspected, after which the party descended to the ground floor, where the huge pumps could be seen pounding away, forcing the water through the great suction and delivery pipes. The deep well, 212 feet deep, with a bore of 14 feet by 10 feet, was also inspected, and then a move was made to the boiler-house, where the five huge Lancashire boilers, the ingenious economizers for utilizing the waste gases, the coal store, and the little tramway for the coal trolleys, were also viewed in turn, after which the party went outside and had a glimpse of the 553,000 gallon reservoir, into which a small river of water was pouring from the deep well pumps. Afterwards the party returned to the engine room, where a hearty vote of thanks was accorded to Mr. Stone for his kindness and courtesy in shewing the visitors round and explaining the working of the machinery. Then, after a brief glance round outside, the party returned to Falmer station, and caught the 4.43 train back to Brighton.

THURSDAY, NOVEMBER 22ND, 1906.

VISIT TO THE PHÆNIX IRON WORKS.

On the invitation of Alderman Every, J.P., a number of the members visited the Phœnix Iron Works at Lewes. The party were shown round by Mr. Broadbent, who explained the working of the large quantity of up-to-date labour-saving apparatus. The visitors were fortunate in selecting a day when a large number of castings were to be made. After seeing the huge furnace, and having the blasting machinery detailed to them, the "pouring" was ready. The sight of tons of molten iron running into the crucibles from furnaces furnished an impressive spectacle. Amongst the machinery that attracted special attention was the knife for cutting the iron girders, so familiar in Brighton,—with "Every, Lewes," on them,—into required lengths. Iron seemed to be treated like wood by the various appliances,—punching holes in 2-inch iron plates, straightening or bending enormous girders, and the hydraulic rivetter pressing the rivets like sealing wax.

In the pattern shop some very ingenious machines were exhibited,—the most prominent being a circular saw that seemed capable of doing some remarkable work. Various specimens of iron were on view, and their value for the industry was explained. The social comfort of the employee has been studied in the magnificent Institute which Mr. Every has built, containing

baths and billiard table, and fine library. Tea was provided for the visitors in the Large Hall. The President thanked Alderman Every for his kindness and for the valuable and interesting remarks he had made in reference to this important branch of National Trade. Mr. Every, in replying, said it gave him great pleasure in seeing the members present, and was sorry that time would not permit of those who had come to the works seeing more, as some of the departments had not been visited.

TUESDAY, DECEMBER 4TH, 1906.

A VISIT TO PRESTON MANOR.

In response to the kind invitation of Mr. Charles Thomas-Stanford, M.A., F.S.A., about five-and-thirty members visited the historic Manor House at Preston. They were received in the magnificent and spacious hall by Mr. Thomas-Stanford, who gave a short history of the Manor, and subsequently conducted the party through the fine suite of apartments, comprising the Anne of Cleves Room, the gem of a drawing room, and the new dining room; and thence to the library, with the Chippendale bookcase of rare books of the fifteenth century. Had it not been known that Mr. Thomas-Stanford is both a scholar and a literary man, one glance at his valuable library would have decided the question.

The picture of Anne of Cleves which hangs in the entrance hall Mr. Thomas-Stanford said was not by Holbein, but was only a copy of the original, which he believed was in Windsor Castle. In the drawing room is an interesting picture of the park and Manor House, painted about 1820.

Beneath the house and extending far under the grounds are cellars of unusual size, which the speaker hinted might have been of service when Brighton was not quite innocent of assisting in running cargoes under Free Trade principles, and was anticipating legislation by a good century.

The following is a summary of the history of the Manor:—

Before the Reformation it was a religious house, and a halting place for pilgrims from Chichester to Canterbury. At the time of the spoliation of the monasteries the Manor passed to the Crown. It was for some time the residence of Anne of Cleves; and the walls of one of the rooms are covered with old Spanish leather of the sixteenth century which, tradition says, she brought with her from the Low Countries.

In 1568 the Manor belonged to Richard Elsington, who, dying in that year, bequeathed it to his wife Marie. She in turn left it to her son by a former marriage, Anthony Shirley. The Shirleys lived here for 150 years, and then became extinct in the male line. Their heiress married a Mr. Western. Their son was killed in 1771 in a carriage accident at Goldstone Bottom, leaving an only child, afterwards the first and only Lord Western. Soon afterwards the whole property was sold to Mr. William Stanford.

The walls of the house are of great antiquity, but the interior arrangements have been remodelled from time to time. In 1788 the existing oak staircase was put in, and other alterations were effected. About 1810 the present lofty drawing room was made by throwing two storeys into one room. Since that date until the recent additions little has been changed.

Mrs. Thomas-Stanford, the present Lady of the Manor, possesses the Court Rolls since the time of James I. The Manor is very extensive, including lands as far away as Bolney and Slaugham. The descent of lands within the Manor is by the custom of Borough English, to the youngest son, and there is a fine of a heriot on succession.

At the conclusion of the visit, the President of the Society, Dr. Walter Harrison, thanked Mr. Thomas-Stanford for his kindness ; and added that the visit was one of great interest to Brightonians, the Manor House being one of the very few links with the past. The members expressed their appreciation by their applause.

WEDNESDAY, JANUARY 16TH, 1907.

VISIT TO ELECTRICITY EXHIBITION AT AQUARIUM.

method of a falling indicator, and the lighting up or extinguishing of other little lamps tells the operator when the "called" subscriber has answered, and when each subscriber has finished his conversation. Thus, after a call is once "through," the operator has no necessity to again "go in" on the line.

On the second floor is the test room. The outside cables, carrying at present some 5,700 wires, open out on to the test board, which is so arranged that any line from outside can be readily connected to any line up to the switch board, each wire being separately protected against lightning. Here also are fitted the "calling relays," one for each subscriber's line. When the subscriber takes his telephone off the hook, the relay is actuated, and lights up the calling lamp on the switch board, the "cut-off" relay adjoining being actuated when the operator answers, and by cutting off the current automatically extinguishing the calling lamp. Close by is the meter rack, in which are fitted the automatic meters which record the number of completed conversations against the telephone numbers of the subscribers originating the calls, the line lamp rack and test clerk's table completing the equipment.

The battery room in the basement accommodates a battery of eleven accumulator cells of 28 plates each, for supplying current for working the board, both for "signalling" and "talking" purposes, with four smaller cells of seven plates each for working the automatic meters. These cells are charged from a motor-generator, of which there are two in the power room adjoining, together with the necessary starting switches, measuring instruments, etc. In one corner are the two motor ringing machines for supplying current for ringing on subscribers' lines; the repeater coil rack and fuse alarm board complete the equipment. The fuse alarm board is fitted with fuses to protect all the various circuits on the Exchange.

In the Brighton telephone area some twelve million messages are carried annually over the National service, there being 5,555 stations working at present. At the conclusion of the visit the President, Dr. Walter Harrison, thanked Mr. Taylor and his colleagues for their kindness in devoting an afternoon to conducting the visitors over the Exchange, and for their interesting explanations and demonstrations.

WEDNESDAY, MARCH 27TH, 1907.

By the kind invitation of Messrs. Pack and Sons, the members paid a visit to the works of this old-established firm. The party was met by Mr. Pack and conducted by him through the whole of the extensive works. Every stage of the process of building the body of a carriage or a motor car was shown, from the wood, metal, &c., in the rough state to the highly varnished and upholstered finished article. A feature of interest was the comparatively large amount of aluminium used in the place of wood for panels in motor cars. Mr. Pack informed the members that most of the wood was obtained from Sweden, this being found the most serviceable for their purpose. One of the many inventions of Mr. Pack was a device for easily raising the body of a car so as to get at any of the parts underneath; this he thought out in bed during a sleepless night. An interesting operation was the fixing of an iron tyre on a wooden wheel; the tyre, which was rather smaller than the wheel, was placed in a furnace, and being thus expanded was dropped over the wheel and the whole flooded with water, when the iron contracted and the tyre became firmly fixed. The various skins used in the upholstering department, although not much to look at, are of considerable value. In the absence of the President, the Honorary Scientific Secretary, Mr. F. Harrison, M.A., thanked Mr. Pack for his courtesy and giving up so much of his time in conducting the party through his works and explaining all the details of the business.

SATURDAY, APRIL 20TH, 1907.

VISIT TO WARREN FARM SCHOOLS.

The Warren Farm Schools and the children in them were under scrutiny on the above date. The thirty-five ladies and gentlemen who indulged in the inspection were more appreciative than critical; and in so well-ordered an institution it would be difficult to be otherwise even if one had the inclination. The members, with their President, Dr. Walter Harrison, believed that an afternoon could be profitably spent seeing how the children of the Poor Law were turned into useful citizens of the Empire.

Mr. E. Rowland Cowley, who is Chairman of the Committee in charge of the Schools, had suggested the visit, and went an

important step further in providing a substantial tea for his guests. Yet another service he rendered was to justify the visit of a Natural History and Philosophical Society to such an institution. As he put it, in thanking the company for a vote of thanks which the President had warmly proposed, they could study no more interesting natural history than that of boys and girls, while there was philosophy in the work of the Poor Law. He added an assurance that it certainly required a philosopher to remain a member of the Board of Guardians. Everyone agreed with Dr. Harrison that the ratepayers ought to make more use of the privilege of seeing the institutions they helped to maintain. Point had been given to this remark by a most interesting demonstration of the Schools' methods.

Mr. H. R. Spooner, the Superintendent, had shown 130 boys executing a dumb-bell drill with the precision of a machine, he had made the band boys play rattling marches, so that the visitors wanted no telling why regimental bandmasters were ever thirsting for Warren Farm instrumentalists; and he had led them through the admirable singing of harmonized hymns and other sacred music. The company had also seen where and how the boys washed, bathed, did their school work, and ate their nourishing food. By the way, no set of boys could do better credit to the table than these chubby little fellows.

After tea the girls were seen performing a skipping drill under the keen but kindly eye of Mrs. Spooner, and there were the well-kept garden, the farm, and the open-air swimming bath to inspect, before a delighted company took farewell of the Schools and all within them. Mr. W. D. Peskett, the Vice-Chairman of the Committee, and Mr. H. Burfield, the Assistant Clerk to the Board, were among those present.

SATURDAY, MAY 11TH, 1907.

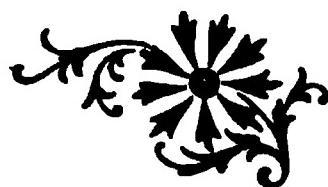
WALK FROM DYKE TO BRAMBER AND VISIT TO CASTLE AND CHURCH.

SATURDAY, JUNE 1st, 1907.

[From *Brighton Herald*, June 8th.]

TILGATE FOREST AND BALCOMBE.

The members had a rather strange experience at this excursion. While everywhere else was steady rain and sometimes heavy thunderstorms, the party escaped almost scot-free. There was one heavy shower, which set in just as the forest was entered at the corner near Worth ; but after a short wait under thick foliage the way was pursued, and after the sticky, clay patch about the brickfield had been crossed the perfectly dry ground of the iron-sand was reached. Just now the verdure of the forest is seen in all its glory. Mr. Henry Davey guided the party through the tracks, and down the descent to the brook (one of the sources of the Mole), which proved more troublesome than usual ; and the opposite slope was very boggy in places. The big double tree has been visited on previous occasions ; and this time it had been determined to take precise photographic records. This should have been done some years since, as the junction has much changed and decayed. It is satisfactory to know that the photographs taken by Mr. Russell-Davies have proved perfectly successful. Leaving the forest through another disagreeable clayey patch, the party crossed the Forest Ridge ; and a hearty tea at Balcombe revived drooping energies. Only a few stayed to make the usual visit to the mineral spring and lake ; but they were well rewarded ; and another smart shower fell just when they were under the thickest shelter. Wonderfully beautiful is all this part of Sussex.



METEOROLOGY OF BRIGHTON.

BRIGHTON & HOVE NATURAL HISTORY & PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 6th June, 1907.

NOTE.—There is a sum of £100 2*s* per cent. *Consolidated Stock standing in the names of Mr. J. COLBATCH CLARK and Mr. E. A. PANKHURST, as Trustees for the Society.*

RESOLUTIONS, &c., PASSED AT THE 53rd ANNUAL GENERAL MEETING.

After the Reports and Treasurer's Account had been read, it was proposed by Dr. HARRISON, seconded by Mr. SPITTA, and resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Report as to the Library, and the Curator's Report, be received, adopted, and printed for circulation, as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

“J. E. Haselwood, E. J. Petitfourt, B.A., F.C.P., F. Merrifield, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., J. P. Slingsby Roberts, W. Clarkson Wallis, E. Alloway Pankhurst, Henry Davey, and Walter Harrison, D.M.D., L.D.S.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

“Mr. A. F. Graves and Mr. I. Wells.”

It was proposed by Mr. H. CANE, seconded by Mr. F. R. RICHARDSON, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year:—*President*: Geo. Morgan, L.R.C.P., F.R.C.S.; *Ordinary Members of Council*: F. R. Hora, B.Sc., E. Spitta, F.R.A.S., F. R. Richardson, Alfred W. Oke, B.A., LL.M., W. H. Payne, and W. A. Powell, M.R.C.S., L.R.C.P.; *Honorary Treasurer*: D. E. Caush; *Honorary Librarian*: Robert Morse; *Honorary Curators*: H. S. Toms and T. Hilton; *Honorary Scientific Secretary*: F. Harrison, M.A.; *Honorary Secretary*: J. Colbatch Clark; *Assistant Honorary Secretary*: Henry Cane.”

It was proposed by Dr. MORGAN, seconded by Mr. D. E. CAUSH, and resolved—

“That the best thanks of the Society be given to Dr. W. Harrison for his attention to the interests of the Society as President during the past year.”

It was proposed by Mr. I. WELLS, seconded by Mr. HUGO TALBOT, and resolved—

“ That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Honorary Treasurer, the Honorary Curators, the Honorary Auditors, and the Honorary Secretaries for their services during the past year.”

It was proposed by Mr. F. HARRISON, seconded by Mr. H. CANE, and carried—

“ That Rule 25 be altered by striking out the words ‘ nor more than nine.’ ”

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society.

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society, The Museum, College Square, N. Belfast.

Boston Society of Natural Science (Mass, U.S.A.).

British Museum, General Library, Cromwell Road, London, S.W.

Cardiff Naturalists' Society, Frederick Street, Cardiff.

City of London Natural History Society.

Chester Society of Natural Science.

Croydon Microscopical and Natural History Club, Public Hall, Croydon.

Department of the Interior, Washington, U.S.A.

Edinburgh Geological Society, India Buildings, George IV. Bridge.

Eastbourne Natural History Society.

Epping Forest and County of Essex Naturalist Field Club, West Ham Institute.

Folkestone Natural History Society.

Geologists' Association.

Glasgow Natural History Society and Society of Field Naturalists.

Hampshire Field Club.

Huddersfield Naturalist Society.

London County Council, Horniman Museum.

Leeds Naturalist Club.

Lloyd Library, 224, West Court Street, Cincinnati, Ohio, U.S.A.

Lewes and East Sussex Natural History Society.

Maidstone and Mid-Kent Natural History Society.

Mexican Geological Institute, 5A, Del Cipres, No. 2,728 Mexico.

Michigan University, Ann Arbor, Michigan.

North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells Bladen, Secretary).

Nottingham Naturalists' Society, University College, Nottingham.

Peabody Academy of Science, Salem, Mass., U.S.A.

Quekett Microscopical Club, 20, Hanover Square, London, W.

Royal Microscopical Society, 20, Hanover Square, London, W.

Royal Meteorological Society, Prince's Mansions, 78, Victoria Street, S.W.

Royal Society, Burlington House, Piccadilly.

Smithsonian Institute, Washington, U.S.A.

South-Eastern Union of Scientific Societies.

South London Microscopical and Natural History Club.

Southport Society of Natural Science, Rockley House, Southport.

Société Belge de Microscopie, Bruxelles.

Tunbridge Wells Natural History and Antiquarian Society.

University of Colorado, Boulder, Colorado.

Watford Natural History Society.

Yorkshire Philosophical Society.

LIST OF MEMBERS
OF THE
Brighton and Hove Natural History and
Philosophical Society.

1907.

N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton. Names printed in italics are Life Members.

ORDINARY MEMBERS.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.
ASHTON, C. S., 10, Powis Grove.

BILLING, T., 6, St. Michael's Place.
BLACK, MILNER, 81, St. James's Street.
BOOTH, E., 53, Old Steine.
BULL, W. 75, St. Aubyn's, Hove.
BURCHELL, E., M.R.C.S., L.R.C.P., 5, Waterloo Place.

CANE, Henry, 173, Ditchling Road.
CAUSH, D E., L.D.S., 63, Grand Parade.
CHARRINGTON, H. W., 23, Park Crescent.
CLARK, J. COLBATCH, J.P., 9, Marlborough Place.
CLIFTON, HARVEY, 19, Buckingham Place.
COLMAN, Alderman J., J.P., Wick Hall, Furze Hill.
COMBRIDGE, SAML., 5, Leopold Road.

DALDY, MANTELL A., Dr., 17, Palmeira Square.
DAVEY, HENRY, 15, Victoria Road.
DENMAN, S., 26, Queen's Road.
DODD, A. H., M.R.C.S., L.R.C.P., 49, Church Road, Hove.
DUKE, Dr. E., 30, New Church Road, Hove.

FAWSITT, H. G. CHATER, 14, Vernon Terrace.
FLETCHER, W. H. B., J.P., Bersted Lodge, Bognor.
FORBES, GEORGE, 5, St. Peter's Place.

GILKES, J. H., Wychcote, Dyke Road Avenue.
GRAVES, A. F., 9A, North Street Quadrant.
GRIFFITH, A. F., M.A., 59, Montpelier Road.
GRINSTEAD, J., 13, Powis Square.
GROVE, E., Norlington, Harrington Road.

HACK, D., Fircroft, Withdean.
HALL, J. SUSSEX, 69, Ship Street.
HARRISON, F., M.A., 30, Compton Avenue.
HARRISON, W., D.M.D., L.D.S., 6, Brunswick Place, Hove.
HASELWOOD, J. E., 3, Richmond Terrace.
HAWKINS, W. R., Shalimar, Withdean.
HAYNES, J. L., 24, Park Crescent.
HENRIQUES, A. G., F.G.S., J.P., 9, Adelaide Crescent, Hove.
HICKLEY, G., 92, Springfield Road.
HILTON, T., 1, Clifton Street.
HOBBS, J., 62, North Street.
HORA, F. R., B.Sc., B.A., A.R.C.Sc., 69, St. Aubyn's, Hove.
HORNE, J., 27, Hampstead Road.
HOWLETT, J. W., J.P., 4, Brunswick Place, Hove.

INFIELD, H. J., Sylvan Lodge, Upper Lewes Road.

JACKSON, J. M., 109, Stanford Avenue.
JENNINGS, A. O., LL.B., 11, Adelaide Crescent, Hove.
JOHNSTON, J., 12, Bond Street.
JONES, RUTHERFORD, Dr. A., Forest Lodge, Maresfield.

LANGTON, H., M.R.C.S., 11, Marlborough Place.
LAW, J., Crosthwaite, Lewes.
LEWIS, J., C.E., F.S.A., Fairwarp, Uckfield.
LIVESEY, G. H., M.R.C.V.S., 29, Osmond Road, Hove.
LONSDALE, L., 13, Powis Square..

MAGUIRE, E. C., M.D., 9, Old Steine.
MANSFIELD, H., 11, Grand Avenue, Hove.
MAURICE, H., L.D.S., 65, St. John's Terrace.
MCKELLAR, E., Deputy-Surgeon-General, M.D., J.P., Woodleigh, Preston.
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Natural History & Philosophical
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ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH

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... FOR THE ...

YEAR ENDING JUNE 10th, 1908.

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SESSION 1907-8.

Address given by the President,

DR. G. MORGAN, L.R.C.P. (Lond.), F.R.C.S. (E.)

At the Conversazione held at the Royal Pavilion, October 4th, 1907.

Function and Fatigue.

IN his Italian sketches, Heine opens one of his chapters by an imaginary conversation with an old lizard. "Nothing in this world goes backward," said the old lizard to Heine. "Everything struggles forward, and in the end a great progress will have taken place in Nature. Stones will have become plants; plants, animals; animals, men; and men will have become gods." Heine's old lizard uttered but half a truth when it spoke thus to him.

There is in the Universe a constant procession from the unicellular to the multicellular taking place, *i.e.*, from the simple to the complex. The root hairs of the vegetable touch and raise the mineral into life, and so build up a store of energy for the animal to consume; but plants and animals alike are but vivified rocks, governed and impelled forward by life itself,—the most mysterious of all forces. Check or destroy that mystic power, and tree or man, flora or fauna alike, fall back to their primitive inorganic atoms. And so the influx of life makes progress possible, and the withdrawal of that same force makes retrogression compulsory.

What is life? The pithy epigram says: "Life is bottled sunshine, and death the silent-footed butler who draws the cork." That definition is as good and as bad as any other, but it has at any rate the virtue of ATTEMPTING to state what life is, whereas most of the definitions, from Spencer's "Life is correspondence with environment," only tell us what life does, not what it is. The fact is, Science knows nothing of the origin and essence of life, and perhaps never will know anything; but of the laws which govern life she knows much, and in the future will know far more.

Assimilation, independent growth, power of movement, respiration, and reproduction are the five chief functions, the possession of which separates both plants and animals from lifeless bodies.

It is of life manifesting itself by function, whether as exhibited in a monocellular plant, or in an organism of a million differentiated cells, that I wish to address you, and also of life disordered and destroyed by over-function, or fatigue.

It is this force which governs waste and repair, and carries out its work with marvellous accuracy. It has been estimated that about one twenty-fourth part of our body perishes day by day, and to repair the loss we consume about a ton of material every year. No part of the present audience existed a year ago except, perhaps, the teeth (especially if false); and yet so accurately has the new replaced the old that, had this audience been photographed a year ago, and again to-night, it would look the same, and individually would feel the same.

The life of all organisms, whether plant or animal, is made up of alternating periods of activity and repose; of function and of rest to prevent, or to repair, the effects of fatigue. There is no exception to this rule. The busiest man has to rest sometimes, or suffer for his folly. The laziest cell must do some work or become atrophied and useless. Yes! and I venture to suggest that, to a certain extent, the same law holds good beyond the limits of the organic kingdom, and is found in the inorganic as well. The soil must lie fallow sometimes, or it becomes fatigued and less productive; and the farmer must humour his fields by a rotation of crops, or the land becomes sulky and unresponsive, and the coming rent day will find him with a meagre balance at his bankers.

Fatigue in some plants is prevented in a way that may strike you as rather remarkable. Mr. Ward in his book on "The Growth of Plants in Closely Glazed Cases" says: "All plants require rest, and obtain it in some countries by the rigour of winter, in others by the scorching heat of summer. Collectors often fail in their attempts to grow certain plants from want of attention to this essential point. Thus most Alpine plants which enjoy an unbroken rest underneath the snow for several months are very difficult of culture in our own mild and variable winter. The winter of 1850-51 was ushered in by some heavy snows with which I filled my Alpine cases, giving the plants perfect rest for three or four months, and with a most satisfactory result, the *Primula Marginata*, the *Linnea Borealis*, and other species flowering much finer than usual. Many of these plants would, I am convinced, succeed well if kept for five or six months in an ice house. Plants in hot countries have their periods of rest in the dry season. In Egypt the blue water lily obtains rest in a curious

way. This plant abounds in several of the canals of Alexandria, which at certain seasons become dry, and the beds of these canals, which quickly become burnt as hard as bricks by the action of the sun, are used as carriage roads. When the water is re-admitted the plants again resume their growth with redoubled vigour. I was surprised to find that John Hunter had explored this field so fully, and knew so much about the methods plants adopted to secure rest and thus prevent fatigue. "Most plants," says he, "have their periods of growth, and periods of rest. Some plants close their leaves, others their flowers, at particular hours of the day or night; and with such regularity does this period of rest take place that more than one vegetable physiologist has proposed to construct from them a floral clock."

Before we proceed to speak of fatigue in Animal life it would be well, perhaps, to define, or further explain the term. Speaking of the muscular system, fatigue is not the same as strain. Strain may produce a dangerous lesion in a moment, fatigue may take hours, or days, or even longer before any serious change in the tissues takes place. A man may attempt to lift a very heavy weight, or to do other very heavy work, and *suddenly*, in a moment, damage his heart irretrievably. On the other hand a man may walk for a long time at his usual pace, and may produce such a state of fatigue as may permanently affect his health, and for the rest of his life leave him with a somewhat weakened muscular and nervous system. Strain is sudden and physical, an altogether unnatural process in the organism. On the other hand fatigue is physiological; it is the result of a normal process carried too far. You might call it over-function. It is of course impossible, in most cases, to state the exact point at which fatigue starts. Nor can we in all cases trust our senses for guidance.

— Weber's Law Explained.

Probably most of the better known examples of fatigue of special nerves are known to you all. How quickly after some strong odours the olfactory nerve reaches its limit of sensation, and becomes temporarily paralysed by fatigue. Two or three short sharp sniffs of an ordinary musk plant will rapidly exhaust the nerve, and prevent its detecting the same perfume again until its fatigue is recovered from by resting a few minutes. If salt is held in the mouth for a short time the nerves of taste become fatigued and fail to respond. That the ears are similarly affected by the auditory nerves becoming fatigued is sufficiently obvious from our use of such terms as "deafening sounds."

Sir Michael Foster says the auditory nerve is capable of rapid fatigue. If the sound be continued long, with almost any note, the sensation diminishes, and finally disappears, and the exhaustion comes on more rapidly with high notes than with low, especially with very high. If the tuning fork be held to one ear, and then,

just as the sound becomes inaudible, be changed to the other side, the sound will be distinctly heard—the fresh untired sense apparatus of the one side is sensitive to the vibration which the tired apparatus of the other side can no longer feel.

Most of you will remember the soap advertisements of twenty years ago to demonstrate the limit of sensation of the retina for certain colours. You were told to look fixedly at the word "Pears" for some short time, until the retina was fatigued, and then to look away from the hoarding to the sky, and you saw the same word in the sky in their complimentary colour. Many a one has paid a big fee for learning that physiological fact, by the loss of a purse or other valuable; for the pickpocket was near studying the student of fatigue, and his fingers had not reached the limit of sensation.

The heart is only a hollow muscle, and is subject to the same laws of fatigue. As it is always on duty, Nature has done her best to guard against exhaustion, by forcing it to rest six elevenths of each second. The lungs too avoid over function by resting more than half their time.

But even these wise provisions of Nature are not always sufficient to protect these organisms from irretrievable damage.

Both the youth, and the city man past middle life, occasionally fall victims through a paper chase or a mountain climb. I am quite sure that in our best public and private schools greater attention is paid to this matter of overtaxing the heart and limbs by too long runs, or being too long in the water, than was the case at one time. Still, more will have to be done in separating the pupils into classes for physical exercise, as is done for mental exercise. In the near future this will probably, I may say almost certainly, be a much simpler matter than it has been up to the present time.

As regards the city men, many of whom do a minimum of muscular work on a maximum of the heavier nitrogenous foods, and *in* this condition (or rather *out* of condition) which this entails, if then they attempt a too sudden, or too prolonged active exertion their hearts and greater vessels are especially liable to suffer from the graver effects of fatigue. Many a one has caused a dilated heart, or aneurism, by a mountain climb, or tramping too far across the moors in pursuit of game.

It must be remembered that in severe cases of fatigue certain poisons, which have a very deleterious effect on the whole system, are formed by the muscles. This has been demonstrated by injecting the muscle juice of a fatigued animal into a healthy one and thus causing convulsions and other symptoms of ptomaine poisoning. These fatigue products certainly predispose the joints, the pleura, peritoneum, and probably the membrane of the brain, to tubercular changes.

Until recent years little attention has been given to the subject of fatigue. Function has always been a favourite study, but not over-function, or fatigue. Isolated facts were known, but the subject had not been opened up either from observation or experiment by any eminent worker. At the present time there are many toilers in this field, and I think the place of honour must be given to Italian Physiologists, both for their enthusiasm and for the originality of their methods. I shall this evening have to refer to their works, and especially to those of Professor Mosso.

Mosso began by observing the effect of prolonged muscular work on quails. He left Turin, where he is Professor of Physiology, and went to the coast to Palo, that he might be present when these birds arrived after their journey from Africa. He found he was not alone in waiting for the quails. There were men present ready to pick up the birds that died from shock. The poor birds are in the habit of arriving almost blinded by fatigue, so that many, in the eagerness with which they seek the land, fail to see the trees, and dash themselves against the trunks, branches, or even telegraph posts, with such force that they kill themselves. It has since been proved that in great muscular effort, and extreme fatigue, cerebral anæmia is produced, and this want of blood in the brain diminishes the power of vision.

Mosso says the poor creatures are so exhausted by their journey that their strength is just sufficient for their flight. When from a great distance they perceive the dark line of the land they are attracted by the white spots representing houses, and steer for them with such eagerness and impetuosity that they reach them, so to speak, before they have recognised them. On examining the bodies of many of these dead birds, they were found to be well nourished, with good muscular development of the pectorals; but their muscles, especially the great pectorals, which had done the chief work of the journey, were very pale and, like the brain, were in a condition of anæmia.

This relationship between intense fatigue and anæmia will explain to you why maids in large towns so often become anæmic. It is largely a question of fatigue of the heart from stair work.

To return to the birds. A quail flies nearly nineteen yards a second, or thirty-eight miles an hour. The journey from Africa to Italy is much easier than at first appears, seeing that from Africa Sicily is visible with the naked eye. The distance from Cape Bon to Marsala is about eighty-four miles. A quail would do the journey in a little less than two-and-a-half hours. The distance from Cape Bon to Rome is about three hundred and forty-one miles, and this should take a quail, flying in a straight line, about nine hours. Another important observation made by Mosso was, that seeds found in the crop of the dead birds, when sown in a garden, nearly always came up, and produced African

flowers. The intense muscular effort and fatigue had stopped digestion. The seeds must have been in the crop at least twelve hours, and probably much longer, for no bird could, in a high wind, take a perfectly direct course. I have no doubt this fact is well known to most of you, that intense exertion, either muscular or mental, inhibits digestion and may for a time stop it entirely.

A quail is by no means the strongest bird on the wing, and, compared with many birds, fatigue seems to come on rapidly; but, let it be said for the credit of the quail family, if they possess less power for sustained effort, their sense of sympathy seems to be more highly developed than in some other birds. Travellers tell us that among the quails that are strongest on the wing, and which have previously gone the same journey, some have been observed at sea, bearing on their backs the tired ones, which have thus in a desperate situation found safety. Some very valuable observations have been recorded of fatigue in pigeons, especially carrier pigeons. Nine pigeons brought from the United States were set free in London; only three succeeded in crossing the ocean, and returning to their homes. After a very long flight the brain and muscles of two fatigued birds were compared with the same organs of healthy birds. The contrast was most marked, and was at once noticed by the professor and students alike working in the laboratory. In the fatigued birds the brain was pale, almost bloodless, and so were the muscles. The rectal temperature was 43 C., one degree C. above normal. The speed of a pigeon is greater than that of a quail, and the former can travel longer journeys with less fatigue. That the strength of animals increases proportionately as their size decreases is a fact well known to old writers. Haller in his treatise on physiology compares the strength of a London porter with that of a horse, and concludes that the former is proportionately the stronger.

Plateu notes that the common beetle can drag along a mass fourteen times as heavy as its own body; other insects can drag as much as forty-two times their own weight. The horse can only pull twice or thrice its own weight. This same writer notes that of two species of insects belonging to the same family, which differ in weight, the smaller and lighter is always proportionately the stronger. An ant can carry a burden twenty-three times as heavy as itself. In no animal is muscular contraction so rapid, or so frequent, as in insects. Lubbock tells us the note of the wings in flight of the common bee is La, that is 440 vibrations per second. In Bombus terristris the male buzzes in La, whilst the female, a larger insect, buzzes an octave higher.

I have spoken of fatigue overtaking birds whilst travelling. Sad to relate, many human beings share a like fate every year. Every year thousands of Piedmontese workmen go to France or Switzerland, returning at the beginning of winter by the valley of

the Rhone. Many die of fatigue in the Pass of the Great St. Bernard. A traveller gives an impressive picture of his visit to the Charnel house, where these victims are collected. He says no one who has once looked through the window of this mortuary chamber will ever forget what he has seen ; here and there upon the flagstones are gathered together single bones, skulls, shreds of clothing half buried in the dust of ages,—the remains of hapless travellers collected and entombed under this spacious vault. Against the walls lean skeletons, which stand upright on their rigid joints. Some of the bodies have arms raised, lips drawn back, and whitening teeth ; with staff stick still in hand, they remain in the strange attitude in which they were first found. There were thirty corpses thus supported. Amongst these bodies was seen a woman holding her child in her arms in such a way that she seems to be offering him the breast. Fascinated, one's eye rests on the form of this mother who at the very moment of death hopes still to save her little one. Like a ray of heavenly light her mother love illumines the darkness, and relieves the horror of this charnel house.

Whilst on the subject of fatigue caused by severe or prolonged muscular effort I will give an illustration of the Myograph tracing, and the ergograph tracing. There are various instruments in use at different colleges. Perhaps the simplest is the one bearing the name of Helmholtz. A frog is killed ; the thigh bone and gastronemius muscle are dissected out with the Sciatic nerve attached. A moment's explanation with a lantern picture will give by far the best impression.

- (a) Forceps for holding frog's femur.
- (b) Gastronemius muscle.
- (c) Sciatic nerve attached to muscle.
- (d) Scale pan.
- (e) Marker recording on cylinder.
- (f) Cylinder covered with smoked paper and revolving by clockwork.
- (g) Counterpoise.

When all these details have been arranged an electric shock is sent down the nerve which immediately causes the muscle to contract, raises the pan and moves the marker which leaves its record on the smoked paper.

MUSCLE CURVE. EXPLAIN.

(m) Represents the curve traced by the end of the lever in connection with the muscle after stimulation by a single induction shock.

(l) The middle line is that described by a lever which indicates by a sudden drop the exact instant at which the induction

shock is given. The lower wavy line (*s*) is traced by a tuning fork vibrating 200 times a second, and serves to measure precisely the time occupied in each part of the contraction. It will be observed that after the stimulus has been applied, as indicated by the vertical line (*s*), there is an interval before the contraction commences as indicated by the line (*c*). This interval, termed *latent period*, when measured by the number of vibrations of the tuning fork between the lines *S* and *C* is found to be $\frac{1}{100}$ of a second. During the latent period there is no apparent change in the muscle.

In the lower the whole curve lasted about $\frac{8}{100}$ of a second, and the upper $\frac{14}{100}$.

I will now show a tracing of muscular shocks written by the leg of a frog which is beginning to be fatigued. In the lower part of the tracing the muscle was acting before fatigue had shown itself, and the contraction is shorter and more sudden than in the upper part of the field, where the tracing shows a contraction and elongation more slow and prolonged.

A description of the instrument and its curves may be seen in Michael Foster, Halliburton, or other good work on physiology.

I turn now to an instrument which will, I feel sure, interest you much more, as by it you can test your own muscle for fatigue, and record it by a tracing. The instrument has been named the Ergograph by Professor Mosso, its inventor.

EXPLANATION

One finger is placed in a leathern loop, the wrist and forearm being fixed as seen in the figure, the loop is fixed to the first phalynx of the middle finger, and to the loop is fastened a cord of catgut, running over a metal pulley, and carrying a weight of three or four kilograms.

Now examine two or three tracings. The first two were taken by Professor Aducco and Dr. Maggiora, the third by Dr. Patrize. Notice the difference in the three.

In the first there is a gradual diminution from the beginning, showing 46 contractions.

In the second, fatigue came on much more rapidly, only the ten first contractions raising the weight to its required height, and the whole record extending to 37 contractions, or partial contractions.

No. 3 shows an entirely different curve. In this there are 41 contractions, all raising the weight nearly to the same height, and the fatigue came on quite suddenly, the finger refusing to respond any longer. These curves are quite natural, and true to experience. We find men and women who differ thus in the rapidity and manner in which fatigue comes on. There are some

in whom fatigue comes on very slowly, but commencing almost at the beginning of any severe muscular exertion. In others the exhaustion does not show itself for some time, but then it comes on so suddenly and emphatically that they feel quite done up, as they say, and can do no more.

To show the value of a period of muscular training, before making the experimental tracing I will show a fourth tracing. It is from the finger of the same doctor as the first on the screen. It shews 78 contractions, as against 46, more than half of which were full ones.

These curves exhibit the objective sign of muscular fatigue. There is a subjective sign also, viz., the *sensation* of fatigue. That is to say, we have a physical fact which can be estimated by one of the instruments I have alluded to, and a psychic fact which cannot be estimated. With regard to the feeling of fatigue, we only perceive it when it has attained a certain intensity. The sensation of fatigue may be delayed by agreeable company, or a pleasant train of thought. Two friends can do a fifteen mile walk, providing they do not push the pace, with less signs of tiredness than each one going alone. The workman who persists in his task, after he is already fatigued, not only produces less effective work, but damages his organism to a greater extent. An objective sign may show itself before the subjective feeling comes on. In healthy action the muscles shorten by about one-third, but when they are getting tired, and sometimes even before we are conscious of the fact, this shortening no longer takes place, and we drag our feet, that is, the usual shortening does not take place to the full extent, and so the heels are not raised. A sense of fatigue may be present even before any exercise has been taken. This may be due to feeble circulation through the muscles, or the blood containing some poisonous products, or to its not containing its normal amount of oxygen. In this case a sharp walk or other form of active exercise improves the circulation through the muscle, and brings fresh supplies of oxygen, and so removes this pseudo fatigue. In cases of chronic fatigue there is nothing better than a course of massage to improve the circulation through the muscles, and so bring back their tone.

Can we proceed a step farther and say what causes these symptoms of muscular exhaustion? Partially, at any rate, I think we can; but I question whether the final answer as to the cause can yet be given. One theory, held by a good many physiologists, including the Italians, is that the lack of energy in the movements of a weary man depends, as in the case of the frog, upon the fact that the muscles during work produce noxious substances which, little by little, interfere with contraction. Professor Mosso says that when the frog's leg has become fatigued by prolonged exertion, we can restore its contractility, and render it capable of

a new series of contractions, simply by washing it. Of course we do not wash the outer surface, but having found the artery which carries the blood to the muscle, we pass through it water, instead of blood. But not pure water, which acts most injuriously on all the cells of an organism,—a fact which it is well to remember when one has to wash deep wounds. The muscle would swell up and die if pure water were introduced into the circulation instead of blood ; hence a little table salt is added to the water (7 grams to a litre, or in English measure, 60 grains to a pint), and this solution closely resembles blood serum. Upon the passage of a current of this liquid through the muscle the fatigue disappears, and the contractility returns and is as vigorous as at the beginning. A similar result may be arrived at by massage. It is well known that a hot bath, followed by vigorous massage, will go far to remove the feelings of muscular exhaustion following any very arduous work. The chief products that are removed by washing the muscle separated from the body, or by massage of the muscle attached to the body are :—Carbonic Acid and Lactic Acid, and certain ptomaines which make the blood of a fatigued animal tonic to another animal.

Other physiologists, especially Professor Herter of New York, and Professor Lee of Columbia University, have approached the subject from another standpoint. Their explanation of the symptoms of fatigue is : that it is caused, not so much by what is formed in the muscles, viz, Lactic Acid, Carbonic Acid and Ptomaines, as by that which is lost from the muscular fibres. You will find the subject discussed in Professor Herter's "Chemical Pathology." His conclusion : Is that it is loss of sugar from the muscle which is the chief cause of fatigue. It seemed to Professor Lee that if this were so, then by depriving the muscles of their muscle sugar, or more correctly glycogen, or muscle starch, then fatigue ought to show itself. In Phlerhizin we have a drug which has the singular property of impairing the combustion of sugar, and of permitting its escape in the urine, thus depriving the cells of the muscle of their supply of sugar. It was found that animals subjected to the action of this drug for several days rapidly became fatigued, and their leg muscles only gave 200 to 400 contractions per minute, instead of the normal 800 to 1,000, on electrical stimulation. This is the explanation of the rapid way fatigue comes on in Diabetes. I have given you the two chief theories. I have no doubt there is truth in both explanations, and the probability is that muscular fatigue is a much more complex state than we as yet suspect. However, much good has been done by the discovery that fatigue means diminution of muscle sugar, and it furnishes you with a scientific excuse for taking some chocolate, or other sweetmeat, with you when taking a long walk. In connection with muscular fatigue I ought to

mention eye strain, which is chiefly muscular in origin. The muscles which move the eyeballs, and the muscles which contract the pupils, and increase the convexity of the lens are all liable to the same exhaustion as other muscles. We have only to remember the Academy headache to realise how severe may be this form of fatigue. This fatigue is what is called Asthenopia. Rest temporarily relieves it. Many workmen who have to use their eyes for fine work see much better at the beginning of the week after the Sunday rest, but in the middle of the week the signs of Asthenopia recur, and cause obscurity of vision with frontal and occipital headaches.

The question of training is too great to enter into to-night, but I would say in passing, it has a real power in delaying fatigue, and sparing the organism from its dangerous influence. The improvement of the digestion, of the circulation, and the action of the skin assists in rapidly eliminating fatigue products. The question of dress, too, is of no less importance. During cold weather, especially if in a cold east wind, there is a real danger of having *too little* clothing, permitting too rapid loss of heat, and so quickening the onset of fatigue. In very hot weather it goes without saying all clothing should be light and loose, and not in any way interfering with muscular contraction.

BRAIN FATIGUE.

By this I mean exhaustion of the Intellectual faculties, and the other special functions of the Brain, and, considering the conditions of life at the present time, I am sure you will agree with me that no subject could be of greater importance to us. I am not going to speak as a pessimist and long for the good old times. Personally I feel no time in the world's history has been better than the present. The chances of the child developing into youth and manhood, and the man living on to middle life, and even old age, are much greater to-day than they have ever been before. But the twentieth century has its own special dangers, and probably the greatest of these is fatigue, and especially *brain* and *nerve* exhaustion. The colon Bacillus and Coccii are hunted to the death by the Medical Officer and his Sanitary staff in Brighton; and I am paying a deservedly high compliment to the efficiency of their work when I tell you that, as far as zymotic diseases are concerned, Brighton compares most favourably with any large town in the Universe. Our lungs and stomachs are guarded most vigilantly by Dr. Newsholme; but I wish the law would empower him to look to the state of Brighton's brain and nerves. Many diseases have been all but banished, but I fear nerve diseases are on the increase. I make this suggestion in no frivolous spirit. Something will have to be done soon, and

as in a short time there will be very little diphtheria, and less consumption, for the Medical Officer to talk of by day and dream by night, I would suggest that his attention be directed to the cause and, when possible, to the prevention of strain and fatigue. A certain amount of strain will always be inevitable both in youth and manhood, but all unnecessary fatigue, or what I would venture to call *unproductive strain*, should be prevented.

Street noises, especially night noises, are one fertile source of *unproductive strain*. Think of the loss of nerve energy that may be caused by a dozen or more thoughtless youths shouting to each other at 4.30 on a Sunday morning. Probably by that noise in the early morning several people would be roused, and would lose an hour or more of sleep, and so energy would be dissipated with no work produced. That is only *one* illustration of unnecessary, unproductive loss of energy ; it would not be difficult to point out others.

Brain.—Roughly, the brain is one-fortieth of the body weight ; but mass for mass it has by far the largest blood supply in the body. Besides several small arteries, it has four very large vessels : two *Int Carotids* and two *Vertebrals*. Its blood supply therefore is as great as that of the two legs and thighs. This will give you some clue as to the amount of work Nature expects of this organ, and her provision against fatigue.

As I shall find it impossible to touch but a few points in this branch of my subject, I have classified the causes of mental fatigue, and, of course, the same classification will apply to physical fatigue.

It may be caused by :—

- (1) An *abnormal* amount of work, in otherwise normal conditions.
- (2) A *normal* amount of work but carried out in *abnormal* conditions.
- (2) Worst of all, an *abnormal* amount of work in *abnormal* conditions.

Of course the *normal* or *abnormal* amount of work are purely relative terms. What would be an easy task for one man or child would be hard work to another.

The abnormal state or environment may be caused by certain well known physical states of health, or want of health, that are inimical to mental work, viz., by errors of diet, either in kind or in quantity ; by too little, or too much exercise ; by states of temperature, or ventilation. These are quite obvious causes of a vicious environment, and would occur to the minds of all. But that the keen edge of one's intellect can be blunted by the condition of the nose and throat is not quite so obvious, but it is just as true. This abnormal condition applies more to children than to adults, but may be found also in the latter. It has been

named by specialists as *Aprosexia*, and has reference to the peculiar want of attention, and loss of memory, and the early onset of fatigue caused by the presence of adenoids in the nostrils and throat. It is thought to be due to the interference of the lymph current through the brain. In some schools the morning's work is too long. Studies from 9.30 to 1.30, with only fifteen minutes' break, will inevitably produce fatigue in both boys and girls who are not strong. Mothers have described to me the condition in which their girls have reached home after an especially fatiguing morning's work. Pale, irritable, passionate, or silent and morose, with hardly energy enough to take food, and with certainly not sufficient digestive power to assimilate it.

A good master will adapt the time and subject of the lessons so as not to overtax and exhaust the brain. He will also see that the pupils have a proper period for relaxation and sleep. The boy or man who studies much, sleeps little, and plays less, is riding for a fall. When Cervantes wished to make Don Quixote mad he made him read much and sleep little, thus his brain became enfeebled, and then it was good-bye to sound judgment.

A word about Examinations. Unless they have been greatly modified from what they were formerly I feel sure they tend to cause unnecessary fatigue. I remember three young men going up for a surgical examination. Part of the examination was a paper in Anatomy and Surgical Anatomy lasting four hours. They started to write at eleven, and continued as though the rest of their lives depended on it, until three o'clock. At that time you may be sure they were all thoroughly fatigued, for the time being, at any rate. They found it difficult to recall the names of drugs or diseases. As this work had to be followed by a *viva voce* at five they were somewhat exercised as to the best way of spending the intervening two hours. Two of their number decided for a good meal and an hour's reading ; the other took a sponge cake and a cup of coffee ; a short walk and a rest on the couch. The coffee, cakes and rest beat the square meal and the hard hour's reading. A short time ago I happened to be in the precincts of the London University as the would be matriculants were streaming out of the examination hall after the three hours' morning mathematical paper. This was at one o'clock. In many of them I noticed very evident signs of fatigue, and when I thought that in an hour these same students would be back at the same desks, with their brains concentrated on work very much like the morning work, I said to myself "Surely this is a very unfair, and a very unscientific way of testing knowledge and judgment." The morning paper was on Arithmetic and Algebra ; the afternoon three hours was spent at geometrical work. In an examination test of that kind physical endurance counts as well as mental ability. I would suggest that fatigue would be much less likely

to come on, if the morning paper started at nine, and ended at twelve, and then an interval allowed of two or three hours before starting another three hours work ; or, if that change could not be made, why not substitute another subject for the afternoon, and save the subject of geometry for the next morning, when the brain would be fresher to deal with it. A change of work is sometimes as good as a rest.

Physiologists can't say with certainty how much fatigue the brain can bear without damage, nor at what age it can endure fatigue without danger.

It must be remembered that fatigue, either muscular or mental, probably bears the same relationship to acute diseases as chill does. It is relatively much more dangerous to come into contact with infectious diseases in the evening, when the vital forces are fatigued, than in the morning, when the same forces are fresh, and have greater resisting power. And as regards the more chronic illnesses, especially of nerve type, there is no more potent factor than fatigue. It is well known that a long spell of sick nursing, continued with loss of rest, in one unaccustomed to that work, will produce such a state of exhaustion of the nervous system as to permanently damage the general health. It is equally well known that that part of the body which is most fatigued is most prone to disease. I have always looked upon boils and carbuncles as evidence of fatigue, and have been able to collect some remarkable cases in support of that opinion.

There is a concurrence of opinion that before the sixth year it is not well for children to work in school. On the other hand moderate mental exercise conduces to the development of the brain. It has been shown that school is one of the most effective means of ameliorating the condition of cretins in places where cretinism exists endemically. A brain must be made to work, just as a field must be cultivated, in order to prevent it from running wild, but the moment study becomes exhausting it ceases to be useful. One ought to exercise the brain constantly, but never to exhaust it. When one looks into it, the function of fatigue of the brain is an immense subject, and one which it is impossible to touch but the fringe of it in an hour's paper. There are certain well defined laws which should govern all head workers and are applicable to all of us ; but outside these every man must be a law unto himself.

(1). Hard mental work should not be attempted after a full meal ; nor when hungry ; nor when very cold ; nor when very tired ; nor in the convalescent stage of an illness, especially if that illness has been influenza. I have known cases of most severe headache coming on and lasting for months from this cause, and one has only to study the daily papers to know how frequently a mental collapse is attributable to this illness.

As regards the regulations which are not so binding, one will prefer doing his best work lying flat in bed or on a couch. I have heard it stated that those whose circulation is feeble get a better activity of brain, and a less degree of fatigue, if they work in this position. Others prefer a gentle walk whilst thinking out some problem. Some find the function of the mind most active in the morning, and work less fatiguing. The brain of others seems most active late at night, when the majority of us are resting. Most workers find rest and stillness necessary for thought, but there are some whose minds become all aglow from the excitement of railway travelling. I must confess that when travelling I have sometimes got an answer to some problem; some lost word has returned when my mind was stimulated by the rapid movement of a railway train. I have known men take a railway journey with the sole idea of stimulating the brain, and starting some fresh train of thought. Others again find it necessary to read a novel to soothe the brain when travelling. I have no doubt that mental work done under the influence of this stimulus must be very fatiguing.

As regards the onset of fatigue, one very important sign of its approach is, when it is found difficult to fix the attention on the work in hand, and when every little sight and sound distracts the mind, and starts some other train of thought. An hour's rest, or some fresh work would be well then. I should take it to be a sign of a functionally active brain when its possessor can continue to work, and do good work, without exhaustion in an environment, which many would consider decidedly inimical to good work. Of the biographies of head workers which I have read not one so impressed me in this particular as that of Sir James Paget. His is one of the most inspiring and instructive lives any one could read. He possessed the power of concentration and attention until quite late at night, even after a very hard day's work, when all ordinary minds would have wandered from the subject in hand. Even in extreme old age he continued to work with scarcely any sign of fatigue, and to work on in rooms where music and conversation were going on. When in practice he was practically always overworked, but he possessed the power of going at once from each duty to the next without a break, as if it were by instinct. In the evening, after dinner, he wrote his letters and filled up his casebook in the drawing room, surrounded by his family, and rather preferred than otherwise to hear the piano and conversation during his work. He seemed to know when to retire, not from any sense of fatigue, but because he felt enough work had been done for the day. His biographer says of him: He worked without fuss in a quiet way that recalls Matthew Arnold's words:—

One lesson, Nature, let me learn of thee,
Of rest unsevered from tranquillity.

It was the power of concentrated attention as the sign of an unsatigued mind and I might add, of a superior mind, which kept Sir James Paget's memory in activity. Charles Darwin considered *attention* the most important of all the faculties for the development of the mind. He tells of a certain man who used to purchase monkeys for the Zoological Society of London for £5 each. He wanted them for training to act in plays, and he offered £10 if he were allowed to keep three or four of them for a few days in order to select one. When he was asked how he could tell in so short a time whether a monkey would prove an apt pupil or not, he replied, "that it all depended on the degree of attention which the animal gave to what was done in its presence." If when he was teaching it anything its attention was easily attracted, as by a fly or other trivial cause, all hope of instructing it had to be given up. An animal when fatigued has undergone a temporary involution, and become of the level of an inattentive monkey. If the brain is fatigued it is almost impossible to be attentive. Galton studied the movements which take place in a large audience, when a lecture has been prolonged so much as to fatigue the listeners. Says Galton, "The art of class teaching consists chiefly in knowing how long, and in what way, one can retain the attention of the students. The best masters are those who never fatigue too much any one region of the pupils' brains, so that their attention being directed, now here, now there, obtains some rest, and so is better able to grapple with the main subject of the lesson.

Beard, an American author, writing of the increase of nervousness across the Atlantic, says, "That at the present time no lecturer can attract very large crowds unless he be a humourist and makes his hearers laugh, as well as cry; and the lectures of the hument, now a class by themselves, are more frequented than those of philosophers, or men of science, or of fame in literature. Americans prefer nonsense to science for an evening's employment. They are so exhausted by the hard toil of the day that they cannot concentrate their attention for anything scientific." Beard is convinced that in no other country is nervous fatigue so common as in the United States. All I have just said on the question of want of attention in fatigue has reference to cerebral fatigue, but it applies equally to severe muscular fatigue. Alpine climbers have noticed that it is well nigh impossible to fix the attention for intellectual work; not only does the attention fail, but memory becomes impaired.

Mosso found in his case, that after climbing Monte Viso and Monte Rosa he could not remember anything of what he had seen from the summit. He says, "My recollection became more and more dim in proportion to the height attained. It seems that the physical condition of thought and memory becomes less

favourable as the blood is poisoned by the products of fatigue, and the energy of the nervous system consumed." Several other Alpinists agreed that the last part of an ascent was the least distinctly remembered.

Yawning, which is caused by temporary anaemia of the brain, is another sign of approaching fatigue.

Aphasia.—The loss of memory for words is called Aphasia, and this certainly comes on quickly in fatigue. Especially have I noticed this sign of exhaustion in surgeons after an anxious operation.

In this discursive paper on a fascinating subject, I have drawn illustrations from many sources. The names of two great British scientists have been mentioned,—Sir James Paget and Charles Darwin, men differing as widely in mental and physical type as in their methods of work ; the one able to persevere in his work well into the night, with little or no sign of exhaustion ; the other, almost at the commencement of his career, became a victim to early fatigue when working, and this followed him right through his life. But this weakness, though it severely handicapped him, was not permitted to stop his work. The inquisitiveness of Charles Darwin's mind was a passion which overcame all difficulties. He has set the scientific world a glorious example of a struggle carried on day after day to the very end.

Before he was thirty, when he returned from his voyage round the world, his health failed so rapidly that he had to abandon London for the quietude of a tiny village, and here, at Down, though his progress was dogged at almost every step by his ever present enemy—fatigue, he plodded on most bravely. His son, Francis Darwin, has told us that he was so much of an invalid that he could scarcely even receive his friends in his quiet country house because, every time he made the attempt, the excitement or fatigue he experienced brought on chills or nausea. Yet this man, in the language of an admiring physiologist has, with his simple country life, his garden and his books as his only occupation, inspired philosophy with new life, and fertilized all the knowledge of our day.

In the little village of Down, in the shade of the tall trees surrounding his house, he thought out and brought to a triumphant conclusion his self-imposed gigantic task.

Shortly after his return from his voyage round the world, Darwin wrote thus to Lyall : " My father scarcely seems to expect that I shall become strong for some years. It has been a bitter disappointment to me to digest the conclusion that the race is for the strong, and that I shall probably do little more but be content to admire the strides others make in science." Later on he wrote to Lyall, " I am coming into your way of only working about two hours at a spell. I then go out and do my business in

the streets, return and set to work again, and thus make two separate days out of one." One of Darwin's favourite sayings was that, "Saving the minutes was the way to get work done." His son tells us that the peculiarities of his indoor dress were : that he always wore a shawl over his shoulders, and that he had great loose cloth boots, lined with fur, which he could slip over his indoor shoes. Like most delicate people, he suffered from the heat as well as the cold. Often a mental cause would make him too hot, so that he would take off his coat if anything went out of the common in the course of his work. For those who experience anything of the paralysing feelings of fatigue, his method of work is worth considering. He rose early and took a short turn before breakfast. He considered the hour and a half between eight and nine thirty one of his best working times. At nine thirty he came into the drawing room with his letters. He would then hear any family letters read aloud as he lay on the sofa. The reading aloud, which also included part of a novel, lasted till about half-past ten, when he went back to work till twelve or a quarter past. By this time he considered his day's work over, and would often say in a satisfied voice, "I have done a good day's work." He then went out of doors whether wet or fine. He would often work up to the very limit of his strength, and would suddenly stop in dictating, with the words, "I believe I must do no more." Thus for forty years he worked bravely on resting frequently to escape fatigue, and, in this manner, he was able to complete his life's work. He died at the age of seventy-three. On the other hand, Sir James Paget was altogether a stronger man, and never experienced this fatigue, except when convalescing from some illness. He passed Darwin's age by twelve years. After his death, his friend Sir T. Smith wrote of him : "During the period of his active life, and until strength failed him, his demon in the Socratic sense was work, and he had but little patience with or sympathy for those who pleaded that they had no time for work. If you have no time, I suppose you can make time, and the more you have to do the more you can do." These are hard sayings, but he applied them to himself in his own work. Paget showed a complete disregard of his health and personal comfort, and in his vacation his pleasure would have been rather hard work to most of us. Now I am not contrasting Paget with Darwin that I may hold him up as a model for our copying. In work, both as regards the manner and the amount, each man must be a law unto himself, within certain limits.

Before you can follow Paget's method of work you must follow him in securing an ancestry remarkable for its longevity and its vigour. Before you can expect to escape fatigue, as he escaped it, you must have the great capacity for constant function, as he possessed it. For most brain workers Darwin is a safer

guide than Paget ; for the warnings of fatigue cannot safely be disregarded, and yet we may learn from that marvellously patient and noble life, that a courageous spirit may prevent feeble health from wrecking a useful life ; and that if regard is paid to the warnings of a tired mind, work certainly prolongs life, and is the surest means of insuring peace and happiness.

I shall close these remarks, already drawn out at too great a length, by citing a most remarkable instance of the sense of fatigue, in its acutest form, being overcome by a brave, indomitable spirit, and, thus, a valuable life being preserved.

All of you have heard of the mountains of South-West Shropshire, and you who are geologists have visited that region in search of the lowest fossil bearing deposits. Of this group of hills the highest, and most extensive in length and breadth, is the Long Mynd. Its summit is a wide expanse of table land, the highest part of which is nearly 1,700 feet above sea level. It is nearly 10 miles long, varying in breadth from three to four miles. Church Stretton at the foot of the hills is rapidly growing in favour as a health resort, and I can personally testify to its invigorating breezes, and its charming scenery. Towards Shrewsbury on the North, the ascent is a gradual one, but on the South-East, or Stretton side, it is wild in the extreme. Running through it are deep ravines, with precipitous sides, at the bottom of which runs a small stream of water, cold and pure. It is recorded that at different times many people have lost their lives amongst these hills, and the record is perpetuated by such names as "Dead Man's Beach," "Dead Man's Hollow," and the last fair held at Church Stretton before Christmas is known locally as Dead Man's Fair, because several men have perished whilst attempting to return home across the hills in the dark November night.

The Rev. Donald Carr, the Rector of Wollaston, a small parish near Church Stretton, used to conduct a service every Sunday afternoon at Rattlinghope, a small mountain church on the opposite side of the Long Mynd, and separated from Wollaston by four miles of wild country. Previous to this last terrible experience Mr. Carr had crossed the mountain over two thousand times, and knew every inch of the road so well, that fog, or mist, or snow, did not deter him from paying his regular visits to Rattlinghope. All the week preceding January 29th, 1875, snow fell heavily, and lay in deep drifts, completely obliterating all the footpaths across the hills. Mr. Carr must have been a man of extraordinary physique and indomitable spirit, for despite all warnings he started on his weekly visit to minister to this handful of people on the hills. His journey proved more difficult than he had expected. The snow, which was very soft, was up to his knees, and the drifts so deep that he could only cross them by crawling on his hands and knees. After the service, not waiting

for any nourishment, he turned homewards for his evening service. By the time of his return journey, however, the weather had completely changed ; the sun had gone down and a fierce gale had sprung up from the E.S.E., driving clouds of snow and icy sleet before it. He had travelled but a few minutes when a fall made him lose his bearings, and strike out in a wrong direction. He left Rattlinghope at four, and then commenced one of the most thrilling experiences anyone had ever passed through and survived. He lost his way completely, and had to continue walking and often falling all through that evening and night, and late into the afternoon of the next day. Snow blindness very soon came on ; he fell down several of the deep ravines, losing his gloves, his hat, and later on his boots, and still he had to go on and on, never daring to rest a moment, lest the sense of oncoming fatigue should cause him to fall asleep, and die. In his own words he says, " After travelling some distance, suddenly my feet flew from under me, and I found myself shooting at a fearful pace down the side of one of the steep ravines which I had imagined lay far away to my right. As I made my way upwards again I saw just in front of me what looked like a small shadow flitting about, for owing to the snow-white ground it was never completely dark. I put my hand upon the dark object and found it to be a hare. I saw many of these animals during the night. They made holes in the snow, and sat within well protected by their warm coats. By this time I was cold and numb, and my whiskers were frozen into a solid crystal beard, hanging half way to my waist. I had lost my hat, and tried to tie my handkerchief over my head, but it was impossible to make a knot, so I could only hold it on my head by keeping the corners between my teeth." Thus he spent the night, walking, crawling, falling, but never still. The day broke calm after the gale of the night had spent itself, and on he went in stocking feet, as it afterwards proved, injuring his feet in the gorse bushes, but never being conscious of it. The whole of Monday morning, as best he could, he tried to steer towards the Carding Mill Valley, and it was well he did, for it was here, when struggling in a drift up to his neck, that he first heard the sound of human voices. Children's voices talking and laughing, and apparently sliding not far off. With what remaining strength he had he shouted to them, but the unearthly sight of a figure protruding from a deep snow drift, crowned and bearded with ice like a ghostly emblem of winter, caused a panic amongst the children, and they ran off and communicated the news that there was a bogie in the snow. Help was quickly at hand, and he was taken to the carding mill, and provided with nourishment and clothing. His friends were shocked to find he could neither see nor taste the food. He was soon driven towards his home, and arrived at Wollaston *twenty-seven hours* after he had left, just

as letters and telegrams were being despatched to many friends that he had been lost in the snow, and that all hope was abandoned. With care, that brave man quite recovered, and lived for many years to minister to these hill tribes, and walk across the same mountain where he had all but lost his life from fatigue, and where others that same night died from yielding to the prompting of their senses.

It makes an impressive picture ; this lonely man on the Stretton hills, fleeing from death as best he knew, struggling on, as he hoped, towards life, straining his sightless eyes and numbed ears for some prospect, some sound of coming help. And how often during those terribly dreary twenty-two hours did he experience the hope deferred, and the sickness of heart which followed. I have cited, at some length, this remarkable instance of a brave spirit manfully fighting his way when almost overwhelmed by a raging storm of snow and sleet, and in greater danger still of being overcome by the suggestion, ever repeated and ever gaining in urgency, from his inward enemy, his increasing sense of fatigue, and yet never giving up hope, but ever pressing on, to remind you that there are elements in this question of fatigue which no Myograph or Ergograph can settle. Mind, after all, is greater than muscle. A man of less powerful build, but of more determined spirit will attempt more, and overcome more, than a mere muscular Hercules. And lastly, may I express the hope that whilst giving every attention to the perfecting of the human body, and so making it a better working machine, with less likelihood of its mechanism being clogged with exhaustion products, our young athletes may not forget that it is knowledge, courage and endurance which tell in the supreme crises of life ; and that these functions need to be developed with the same pride as is taken in the increasing biceps ; and that the mind must always maintain its rule over all the functions of the body.

FRIDAY, NOVEMBER 1ST, 1907.

Weather Forecasting,

BY

MR. W. MARRIOTT, F.R.M.S.

Illustrated with Lantern Slides.

A N instructive insight into the methods by which the meteorological experts arrive at their daily forecasts of the weather was afforded members of the Society by Mr. W. Marriott, F.R.M.S., who came down from London to lecture on the subject. Mr. G. Morgan, the President, introduced the lecturer, with the comment that as no part of a man's environment subjected him to so many surprises as the weather, few matters could be of more interest to them. The lecture followed very appropriately upon the recent visit paid to the meteorological station at the Brighton Town Hall, and Mr. Marriott now showed by lantern slides of charts how observations from such stations all over the world were collated daily and made to yield deductions from which it was possible to construct fairly reliable forecasts. It was necessarily a very technical lecture, but it was made surprisingly lucid, and one incidental feature that was greatly enjoyed was the exhibition of a series of beautiful photographic cloud studies. Mr. Marriott was able to tell the south coast—and Brighton in particular—some flattering facts about its immunity from rain and fog, and its big proportion of sunshine as compared with other parts of the country. Brighton averages just over 1,700 hours' sunshine in the year, while London has only 1,260; and in the winter months the figures in Brighton were double those in London. It was probably news to most that there is an average of 22 calm days a year in England, and that on an average the wind comes from the south-west on 106 days. Several members afterwards put questions to Mr. Marriott, who was heartily thanked for his interesting lecture, on the motion of the President, seconded by Mr. F. Harrison.

FRIDAY, NOVEMBER 18TH, 1907.

A Year and a Half among Savages (BRITISH NEW GUINEA),

BY

MR. A. H. DUNNING, F.R.G.S., F.R.P.S., &c.

Illustrated with Lantern Views.

MR. A. H. DUNNING at the commencement of his lecture asked his audience to imagine themselves in a portion of the globe as different as possible from any civilised country, in a land many parts of which have not been visited by the white man, but where all its native wildness, both of scenery and of inhabitants, is retained in its pristine state. It is a country where the "simple life" reigns supreme; and where men live under the most primitive conditions conceivable. The lecturer remarked "there are tribes in the interior who have not yet advanced beyond the 'Stone Age.'"

Taking his audience in imagination, illustrated by a series of fine lantern slides, Mr. Dunning conducted them to the Benstack River, then westward, throughout the whole of the British Possessions as far as the Islands off the West Coast.

First visiting the Roro and Moorhead Tribes, he thence proceeded to the Fly River, on the banks of which the natives were seen making sago pulp—a method which hardly commended itself to the educated tastes of occidentals.

Some interesting negatives of the lake houses were shewn, taken under circumstances of considerable difficulty by reason of the panic that ensued when the necessary magnesium flash-light was applied.

Passing on to the Aird River Delta, Mr. Dunning came across the actual murderer of Dr. Chamber, the eminent Missionary.

Mareas and the natives of Waima, and the Nara tribes were visited, whose love-charms caused amusement when the lecturer stated that he required a bottle of strong smelling salts to overcome their potency. The Kabidi dancers and the native method of removing superfluous hairs also produced merriment. Mr. Dunning informed his audience that owing to the influence of civilisation a piece of broken glass is now preferred to the primeval razor—a sharp flint!

A series of pictures followed, showing a Motu girl undergoing the painful operation of tattooing ; the method of fishing with a torch and a hand-net from the Lakatoi canoes ; pottery making ; a spear fight at Hula ; and native pig-hunting.

During the short interval some native music—a love song, a war song, and a duet—were reproduced from gramophone records.

Resuming, Mr. Dunning explained the types of houses built out in the sea, also those in treetops.

The ladies were next given some domestic hints on cooking pork, which were not so favourably received as might have been expected from the lecturer's glowing description.

A series of original photos followed, of a boy making a fire with some wooden fire sticks ; of the native tobacco pipe and the ingenious dog ladders ; and string manufacturing and dressmaking. Some pictures of curious burial ceremonies, together with some very artistic and interesting views of Lakatoi canoes, brought the lecture to a conclusion.

FRIDAY, DECEMBER 6TH, 1907.

Restocking of Flora and Fauna,

BY

MR. HENRY DAVEY.

THE problem, said Mr. Davey, of preserving fauna and flora which man's interference threatens with extinction, is much less simple than appears on the surface. The largest and most highly developed mammalia, such as the elephant, the bison, and the lion, are the species most in danger, and nothing but strict preservation can save them. The more beautiful and local birds, the birds of paradise and the lyre-bird, require equally strict preservation. Whether preservation, however thorough and complete, will be altogether successful is just a little questionable ; and I shall give reasons for showing that other factors besides man's attacks may be involved. The examples will be taken from butterflies, the only department of natural history with which I can claim to have some real acquaintance, and which happens to be specially fertile in suggestive facts. These established, I shall show briefly how they affect the question of restocking.

All entomologists will tell you that butterflies have become very much rarer within living memory. The pride of English entomologists, the glorious Large Copper found only in the English Fens, disappeared sixty years ago quite suddenly. Several other species seem extinct ; and in general all kinds, excepting the mischievous Cabbage Whites, are far less abundant than formerly. The explanation seems obvious, that too many entomologists of all ages continually attack them ; while the modern facility of locomotion—a facility considerably enhanced during the past generation—continually narrows retreats of undisturbed retirement where nature is independent of man. Yet what I am about to tell you will throw a different light upon the subject, and you will see that other causes are in operation.

The first consideration, though not the most important, is Dame Nature's trick of producing during one particular year a more or less rare species in countless profusion. The beautiful and swift Clouded Yellow butterfly thus appeared in 1865, 1877, 1892, and 1900. In the preceding and following seasons it was a rarity. Still more prized is the Pale Clouded Yellow, swifter though less beautiful than its relative, and generally very rare. In 1868 it was extremely common, never subsequently. Why should this be ? That year was very hot and dry ; but the butterflies must originally have been eggs laid by females, and however favourable the weather, the problem remains. When and where did the females lay the eggs that inexplicably produced countless butterflies of a species extremely rare in other years ?

Why, too, did not the ordinary Clouded Yellow, whose life story is practically the same, also appear in its multitudes in 1868, as it had done years earlier ? These questions still remain for solution. Again, in 1872, when I was the Society's youngest member, I announced the capture of a Camberwell Beauty ; and was informed they were fairly common that year. Ever since they have been extremely rare.

More profound is the subject I next touch upon. Our South Downs are peculiarly suitable to blue butterflies, whose caterpillars feed on plants common here. But the Large Blue (*Lycæna Arion*) is not found here, or in all this part of England. And its life history has been quite unknown till just lately.

The Large Blue has always been a valued prize among English butterflies ; though usually very common where it occurs, it favours slippery and dangerous places, such as old quarries and rocky pastures, and in a few counties only. The localities formerly known were Barnwell Wold in Northamptonshire, and three places in the Cotswolds ; afterwards South Devon and Cornwall. From all parts of England entomologists used to visit Barnwell Wold ; and sure enough the Large Blue was killed off there. It also disappeared from the Cotswolds and Devonshire,

I believe, about thirty years ago; and a valuable work, published in 1903, asserts the Large Blue is extinct everywhere except in North Cornwall. But now a number of facts, all of the highest interest, have been discovered by Mr. Frohawk. In 1896 he watched the females laying eggs on wild thyme, carried off the plants, and hoped to solve the problem of the life history. Caterpillars were duly hatched; and all went well till the third moult, when they refused to feed, and appeared to wish to hide underground, till in despair Mr. Frohawk turned them loose. Again, in 1902, he went to Cornwall and watched the females laying. Then he noticed one fact which contains the key to the mystery. The females always chose wild thyme growing on ant-hills. Following up this suggestive clue, he succeeded in discovering full-grown caterpillars living underground; and saw that the ants suck off a secretion produced by the caterpillars, just as they suck the sweet secretion of the aphides, or blight. Both ants and caterpillars are probably interdependent; and if some external circumstance should affect the life of the one the other would also suffer. This leads me to a consideration of other phenomena also furnished by the same butterfly.

As I mentioned, the Large Blue, formerly common in the Cotswolds, disappeared thence about thirty years ago. Last year it unexpectedly reappeared in one of its old haunts; and though both last year and this have been most unfavourable to butterfly life, the Large Blue has unmistakably re-established itself in Gloucestershire. After thirty years' death it has revived to vigorous life. This fact, however inexplicable, is not surprising in view of the abundance of rare butterflies in particular years.

But far more remarkable is a fact concerning the Large Blue announced about ten years ago. At a meeting of the Entomological Society the President announced the absolute extinction of that butterfly in the favourite hunting-ground, Barnwell Wold; but he added that it had also disappeared from a park in Northamptonshire to which the public were not admitted, and where it had been abundant.

Related facts about the Swallow-Tail and Mountain Ringlet butterflies were also cited; also the abundance of the Marbled White at Holmbush, near Poynings, in a space only about 80 yards square.

Therefore, continued Mr. Davey, the simple walling-round of a sacred enclosure where rarities can be safe is not all that Nature wants; and if Nature chooses to produce an abundance she will do it. I have drawn my instances from butterflies, but the same holds good of plants; they will be very common when and where Nature chooses. And I have come to the belief, though without full proof, that if Nature is left to itself the extinct species will reappear, but only up to a certain point of development: we may

be sure that the elephant and lion when really extinct will not reappear even if all Africa be left a desert, nor, I think, any really extinct vertebrates, even fish or reptiles.

What, then, should be done on the question of restocking? Is it advisable to select places apparently suitable, especially places where species have been killed off, and judiciously leave individuals to establish themselves and multiply? I think it is advisable; though the facts I have given show we must not be too hopeful. The problem is not the same as that of introducing species into a new country, which has had such grevious results in Australia and elsewhere. The task should be undertaken in a scientific spirit and with practical management, whether by societies or by individual naturalists. Exact records should be kept and observations noted, for guidance in the future. Nature is immeasurably stronger than our schemes can be to produce: we are strong only to destroy. If Nature helps our restocking it will be successful, otherwise a failure; and the lower forms of life multiply so prodigiously that the least encouragement from Nature makes them swarm in countless multitudes. You are all familiar with the Darwinian arguments on this subject. The one hundred eggs which a butterfly lays are not numerous in comparison with the eggs of a codfish or a herring; yet if they multiplied without check there would in a few years be no food to supply the caterpillars. Restocking should therefore be tried, but not with overmuch confidence, as the result depends on a stronger power than our own.

FRIDAY, DECEMBER 6TH, 1907.

Autochrome Plates,

BY

DR. W. A. POWELL, M.R.C.S., L.R.C.P.

Illustrated with Lantern Slides.

POSSIBLY a few notes on the latest process in Colour Photography might be interesting to you, as with this new photographic plate known as the autochrome plate, one is able to record almost all objects as they appear in nature and in their natural colours. As far back as 1869 M. Louis Ducos du Hauron originated a method of colour photography by means of a screen

plate filter, on the assumption of the theory that every colour may be produced by suitable combinations of the three primary lights (not pigments), red, green, and violet. White light, as you know, is made up of a compound of seven colours—red, orange, yellow, green, blue, indigo, violet—which is clearly demonstrated by dissecting a beam of sunlight through the spectrum, but it is known that it is not necessary to have all the seven colours to reform white light ; if we mix the red, green, and violet we shall get a very good white, which I will demonstrate to you by means of the triple lantern which we have here. In front of each lens is placed a piece of coloured glass, one red, one green, and one violet ; if they are focussed upon the screen the effect is white. I will also now show you the effect of mixing these colours. These three colours are known as the primary colours, and with these, by mixing in various proportions, we can make all the colours as seen in nature. I will focus the red and the green on the screen, and the effect as you will see is yellow. The red and violet when mixed produce pink. The green and the violet produce a green-blue. Now, if with any of these compound colours produced by the mixture of any two of the primary colours we add the other primary colour we get white, as you will see by focussing the violet and yellow—we get white (quite different to the mixing of pigments, which would give green). The pink and green give white. The green-blue and red also give white. This also explains what a complementary colour means, viz., supplying a deficiency, the particular deficiency being in the case of colour that which is necessary in order to reform white.

As my time is limited I am sorry that I cannot explain to you how the sensation of colour is produced to us, but colour is a physiological phenomenon produced by a physical difference in the wave length of light, a sensation formulated in the brain, depending entirely upon a difference in the wave length of light. Absorption of colour, too, is another phenomenon which would occupy too much of the time to go into this evening, but I may give you a short explanation of this by saying, that it is the property which a substance possesses of absorbing certain rays of light possessing a definite wave length. Grass is green because it possesses the faculty of absorbing all the rays of light except those which produce the sensation of green.

Acting upon the idea of M. Ducos du Hauron, and the same theory, Messrs. Lumeire, of Lyons, have manufactured a photographic plate to record colour. A piece of glass is coated with a series of filters in the form of minute grains of starch dyed red, green, and violet. Upon this is spread a film of emulsion which is sensitive to all parts of the visible spectrum. The plate is placed in the dark slide with the glass side towards the lens, so that the light in order to reach it must pass through the coloured

starch grain filter. Exposure is made, the plate developed, and then, before the plate is fixed, the negative image is dissolved away and the remainder of the sensitive emulsion film re-developed, thereby producing a positive corresponding to the negative first developed. The plate is then fixed, washed and dried, and varnished. Let us trace what has happened in this process in the light of the three primary colours of white light, viz., red, green and violet. We will suppose that we are photographing an object that is pure red, *i.e.*, the colour of the red grain in the filter of the plate. The rays from this object being red only, would be obstructed by the green and violet grains in the filter and would produce no effect on the sensitive plate, but they would pass through the red grains and would affect the emulsion, producing a deposit of silver when the plate was developed.

On the plate at this stage being illuminated from behind by white light, this deposit (the first negative image) would obstruct the light coming from immediately behind it, that is to say, it would cut out the light coming through the red parts of the filter, but the other portions of the filter having no obstruction on them, due to the silver image, would pass their respective colours, viz., green and violet, with the result that we should have the red object represented in the colour which is the result of mixing lights of these two colours, that is to say greenish-blue. In other words, a colour complementary of the red is produced. But when the negative image has been converted into a positive one, the conditions are precisely opposite as regards the obstruction offered to the light by the silver deposit. Now the green and violet grains and the red is bared ; with the result that on the picture being examined by light passing through it, the light reaches the eye only through the red portions of the filter film and the object is seen in its actual colour.

I am indebted to Mr. George Brown, Editor of the "British Journal of Photography," for many of the very fine specimens of landscape and flowers shown. Also to Mr. Stanley Read, Secretary of the Hove Camera Club, who has kindly lent me his collection. The microphotographs are prepared by Mr. Caush, and are the first I have seen of the kind ; I am sure no better ones could be produced.

FRIDAY, DECEMBER 6TH, 1907.

Colour Photography,

BY

MR. OTTO PFENNINGER.

A THIRD lecture was given by Mr. Otto Pfenninger on Colour Photography in general and the application of his invented One-Exposure-Camera for Colour Photography in particular.

When opening his lecture he said that colour photography could easily be classified into four groups.

Group 1.—Heliography by prismatic interference. Zanker and Wiener gave the first ideas of this process, and Professor Lippmann in Paris brought the process to a practical issue, which is, however, not applicable to publication through the press or printing on paper, and can only be used in special viewing instruments.

Group 2.—The additive method of colour photography is best known in one of its applications, the chromoscope. This instrument was first theoretically suggested by Ducos du Hauron (France), in 1869, and then 23 years after its first publication it was introduced in a practical form and commercially exploited by Ives, of Philadelphia. The chromoscope is a viewing instrument, and up to now it was impossible to use the instrument for the subtractive method, because three negatives of same size could not be produced. The ordinary chromoscope is defective, in so far that the refractions caused by the glass reflectors are not compensated. The defect is of no account however if the photographs are taken as well as shown in the same instrument.

Group 3.—We have colour photography by the coloured lines or screen-lipate systems, which was also indicated by Ducos du Hauron as far back as 1869, but no results were shown. Professor Jolly, of Dublin, elaborated the system and showed some results, and he proved the correctness of the theoretical suggestions of Ducos du Hauron. Others followed on the same lines, and lately Warner-Powrie, of U.S., showed some wonderful results; the colours are very bright and less heavy than in the Lumière autochrome. The orange, green, and violet lines which form the screen in Warner-Powrie's photos are very fine, but not so fine that the eye does not detect them in the transparency. There are already a great number of new patents announced, which claim to do better, but the main idea of all of them is, to form a layer of three colours in line, or mosaic or irregular dots (like Lumière's autochrome), side by side on a plate and then to cover the layer

with a photographic light sensitive film, which latter has to be colour sensitive to all colours, and when exposed through the layer of transparent colours will be exposed, or acted on, in just the proportions of the different lights passed.

When such an exposed plate is developed it will be a negative, as in all such photographic processes, and to show the plate in its true colour effects a positive picture is required. It is therefore necessary to reverse the photographic light action on the plate, so that opacity is formed where transparency is shown in the negative, or where the light has not acted on, and *vice versa*. There is one great drawback to the processes belonging to this group, that is, duplicates will never show the same brilliancy as the first transparency made, if such duplicates can be made. A further drawback is, that colour printing from such transparency is for the present out of the question, and all advances in such directions have to be accepted with a fair amount of reserve for a good while to come.

Group 4.—The subtractive method of photography in colours, also foreshadowed by Ducos du Hauron in 1869, is practically the only method allowing the colour printing to be done by the aid of three negative colour records, giving thereby facilities for multiplication in nearly any colour printing process.

One Negative is required which gives all the yellow as transparent, all the greens and oranges, more or less transparent, that is just in such proportions as yellow is present ; such a negative colour record is obtained by any ordinary dry plate as sold in the market. Or a like negative colour-record can be obtained by a colour sensitive plate which receives all light through a blue violet colour filter, a filter filtering out, cutting-out, making non-acting all colours but blue.

A second Negative is required which has to be printed in red, and for that purpose the red colour of any object to be photographed has to be rendered by transparency in the negative-record and the blue must be shown by half-transparency. Such a negative we obtain with an ortho-chromatic, that is erythrosin bathed plate and an adjusted yellow filter, or with a plate sensitised to all colours when exposed to light, the latter has to pass or is filtered through a green filter, which latter cuts out or makes non-acting the light rays which are not required to act on the photographic plate.

A third Negative, which represents the exact opposite as the first named negative and has to be printed in blue, shows therefore this colour by transparency and is obtained through an orange red filter on a photographic plate which is sensitive to all colours. This filter, if properly adjusted, will not allow any blue active rays to pass. The absence of light action on the sensitive plate will here, as in the other negatives, indicate the colour in which to print.

When we have the three different negatives colour record as explained, the same are then printed in the colours indicated above, and each colour is printed in succession on the other, so that a complete print is only formed when holding a blue, a yellow and a red impression. The name applied to such a print is three-colour print.

The ordinary way to produce the three necessary negative colour records is with a camera having a repeating back or by change of slides. That is by three different and distinct exposures, thereby limiting the subjects to be photographed in colours to absolute stationary objects.

Different attempts have been made to take the three negatives with one exposure, and for that purpose the chromoscope has been tried, but found wanting, because three negatives of same size could not be obtained therewith. A chromoscope as generally known has not less than two reflecting surfaces ; but there is a reflecting system with only one mirror, known as Bennetto's system. I have tried to use this system, but found that the refracted image was shorter from top to bottom when compared with the reflected image. Now if one glass reflector, like in Bennetto's camera, interferes with the size of the picture, it should become obvious that double this interference will not improve a chromoscope camera with two glass reflectors. I have succeeded in correcting this interference, which is caused by the difference of a longer refraction at the top of the glass reflector to a shorter refraction at the bottom of the same glass reflector, which latter is inclined at an angle to a light cone coming from the optical centre of the lens. The correction consists of a plain glass plate of same substance as the reflector, and by inserting same at a like angle as the reflector, but in opposed direction ; that is, if the reflector acts from top to bottom, the compensation acts from one side to the other side. By forcing each light ray to pass the two refractions as indicated the negative at the back is foreshortened in all directions alike if left in the old focussing plane, but by placing the plate a little further away in the proper, through refraction displaced, focussing distance, it will be found that this double refracted picture will be sharp, of equal and correct size, when superposed on the reflected image. The patent 25907, 1906, embodies the necessary improvements to take the three negatives of same size, with one single exposure and with one lens.

To take three negatives with this camera : One is taken at the back, the blue record through the red reflector.. The second negative is taken by way of reflection from the red reflector through its own glass surface at the top, therefore being not reversed. The third negative is on a flexible plate and is obtained on a ortho-chromatic plate pressed film to film, with the second plate which acts as yellow filter. By printing

this flexible plate through the back the print will be reversed again, without losing the necessary sharpness.

To illustrate the manifold usefulness of the invention the lecturer showed about two dozen lantern slides, including some remarkable snapshots of outdoor life, children on the Brighton Beach, etc., all printed by Dr. Jumeaux's process. He also showed from the same negatives three-colour prints by the carbon transfer process; also some colour photos taken half-plate size in block printing and carbon printing, which show by the absence of colour fringes their superiority over three colour prints of which the negatives were taken in succession by a repeating back camera.

In a conversation we had lately with the lecturer he said: "I had hoped to find such interest in Brighton (the birthplace of the invention), or in London, as to be able to launch out in a commercial enterprise, but I find the proverb is true: 'The prophet is not acknowledged at home.' However, the Imperial Austrian School of Photography has taken a great interest in my auto-didactic studies and advancements in colour photography."

The diagrams given were explained on an actual camera by the lecturer.

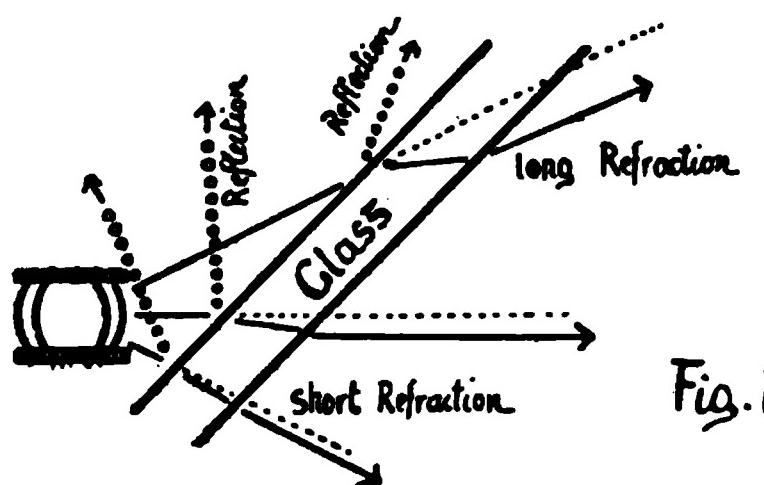


Fig. 1

Fig. 1 represents a glass interposed at an angle to the light cone coming from a lens, and shows the reflections and refractions.

Fig. 2 is the skeleton of a camera.

T = Orange red Reflector.
T₂ = Compensation.
P = Place for Back Plate.
P₁ = Place for Top Plates.

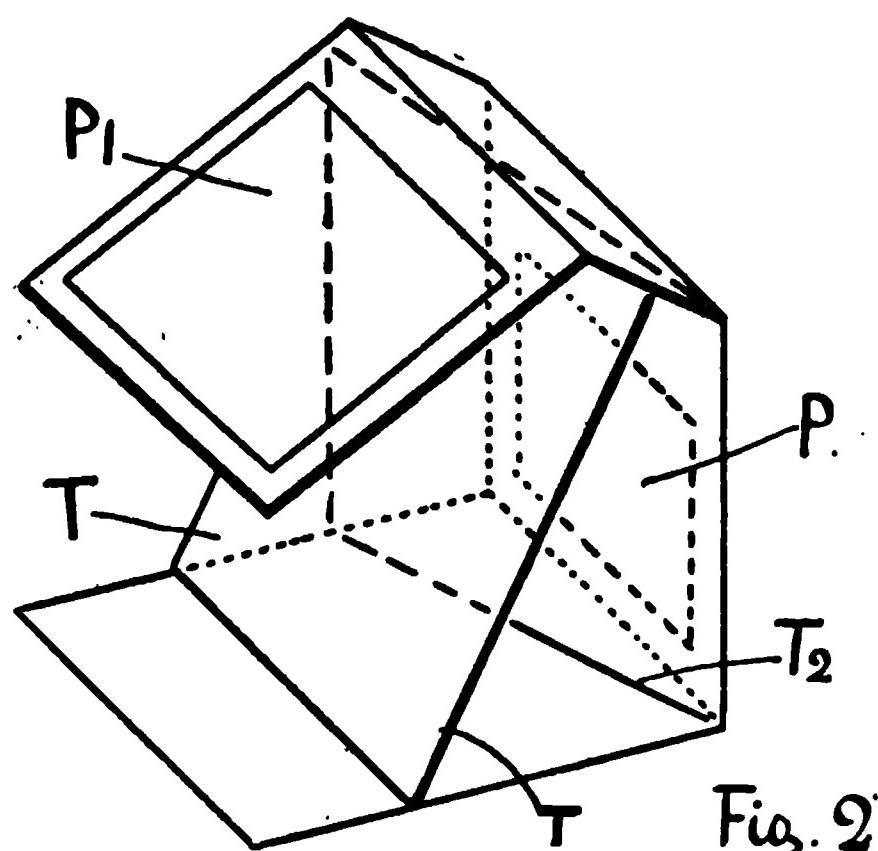


Fig. 2

FRIDAY, JANUARY 10TH, 1908.

British Orchids,

BY

MR. H. EDMONDS, B.Sc.

ORCHIDS, the Lecturer observed, were widely distributed, being found everywhere except in the Polar regions, but they reached their greatest development in the hot, moist atmosphere of tropical forests. Here they were usually found as unbidden guests growing on branches or trunks of trees. But although flourishing in such a position they were not parasitic. They did not take their nourishment from their hosts as was the case with the dodder and the mistletoe; they were provided with remarkable aerial roots which, hanging down in the atmosphere, took their nourishment from the gases present and the moisture, which they condensed. The family was a most extensive one, the latest trade list giving some 3,500 orchids as against 2,000 chrysanthemums and 1,800 roses. Yet though so numerous no specimen appeared so prolific in individuals as to constitute a feature in the landscape. The British orchids numbered about 40 species, distributed among some 16 or 17 genera. Of these species, according to the new edition of Arnold's "Flora of Sussex," 28 were found in this County. Some 15 of these species were described in great detail by Mr. Edmonds, his remarks being illustrated by many lantern slides.

At the close of the lecture Mr. G. Morgan conveyed the thanks of the audience to Mr. Edmonds, and observing that in Shropshire, where he formerly lived, he had never found a third of the orchids that he had discovered in Sussex, asked what determined the growth of the flowers. Mr. Edmonds replied that many of the orchids seemed to grow upon chalk, while the bee orchids and others were to be found only on the northern side of hills—never on the sunny side. There also seemed to be certain heights at which they flourished.

FRIDAY, FEBRUARY 7TH, 1908.

Caird's Idea of Criticism,

BY

REV. DR. JEFFREY JOHNSTONE, F.R.G.S.

IT is perfectly clear from a study of Dr. Caird's works that although he was quite familiar with the "common sense School of Philosophy" of Scotland, founded by the famous son of King's College, Aberdeen,—Thomas Reid; and the English Empirical School, founded by the illustrious Bacon of Verulum, yet he appears in no way to have been influenced by them; while the fact that he has written a most significant essay on "Cartesianism," *i.e.*, the Rationalistic School founded by de Cartes, and published an important book on the "Religion and Social Philosophy of Comte," shows, at least, his deep interest in that rationalistic philosophy which developed into the Pantheism of Spinoza, with its divine immanence on the one hand and that positive philosophy which developed into the synthetic philosophy of Herbert Spencer on the other. In the case of the great Greek School of Philosophy, we discover everywhere in Dr. Caird's writings his indebtedness to those early thinkers and devout and eager searchers after truth; the influence of Heraclitus, Socrates, Plato, Aristotle—and in a lesser degree—the Stoics, is especially conspicuous in all his books. The Alexandrian School of Philosophy, founded by I'hiilo, has influenced him not a little; it is here that he discovers the meeting and the mingling of Occidental and Oriental thought, the thought of Greece and the thought of Palestine, philosophy and Christianity expressed in the term—Logos, "thought made flesh"; while Plotin, the greatest of the Neo-Platonists, is in no sense a negligible quantity with Dr. Caird. But it is not to Africa, Greece, France, England, or Scotland that we must look if we would discover the real source of our author's inspiration, and the influence which has operated so powerfully on his mind; it is to Germany,—to the University town of Königsberg, to the great modern School of Critical Philosophy, for ever associated with the renowned name of Emmanuel Kant, and his later distinguished follower Hegel; it is to these wells we must turn if we would identify the fountains of Dr. Caird's largest inspirations, and the influences that have most powerfully affected the drift of his thought.

Dr. Caird has given continuity in the history of western philosophy to the body of idealism which assumed its primitive shape in the hands of Plato and Aristotle, and arrived at its critical ultimate in the systems of Kant and Hegel ; with him the real is the rational and the rational is the real. The direction and movement of Dr. Caird's thoughts, as we follow them through all his works, could not be better or more forcibly expressed than in his own words : "The movement of philosophy," he says, "is a movement towards a more complex and, at the same time, towards a more systematic view of the world ; philosophical thought is ever seeking on the one hand to distinguish and even to oppose to each other the different sides of truth which were at first confused together, and again, on the other hand, to show what were at first supposed to be contradictory are really complementary aspects of things. (a)

This then is the trend of his philosophy, and the postulate by the constant application of which he attempts to resolve all difficulties and reconcile all opposites. It is a unity which is at once self-differentiating and self-interpreting, which manifests itself in difference that through that difference it may return upon itself. What we are never permitted to forget, in all sections of Dr. Caird's works, is the fact that he is a critic, but a critic in no narrow and ambiguous sense ; he is a critic in the sense in which all true philosophers are and must be critics, as Socrates, Plato and Aristotle are critics, and as Kant himself, the renowned author of the Critical Philosophy, was a critic ; for it must be borne in mind that philosophy, as it is represented in history, is not merely a continuous stream of human thought, but a series of progressions followed by critical regressions to the original fountain in view of farther progress. A great thinker may begin his career by simply absorbing the thought of others ; but afterwards he becomes the critic of what he has absorbed, and the very moment he becomes the critic of what he has absorbed he strikes fire as it were, he finds something he objects to in what he has absorbed, but he also finds that the thoughts of others which he has absorbed have a deeper meaning and a fuller content than the authors themselves perhaps ever dreamt of. This deeper meaning and this fuller content the critic, who is also the philosopher, unfolds with the result that he adds something new, something positive, and something permanent to the intellectual resources of mankind. Now this is exactly what Dr. Caird has done ; he has not gone outside the great stream of thought, but has painfully and laboriously wrought inside the current, and done original work of a permanent character, by detecting and discarding the errors in the systems of others, and making fresh discoveries himself, by a

gradual process of evolution. In confirmation of what we have just said, Dr. Caird says : "The only valuable criticism is that which turns what is latent in the thought of a great writer against what is explicit, and thereby makes his works the stepping-stone to results to which he did not himself attain." (b)

In our paper we have tried to do justice to our old Master, by placing well within the canvas as complete a picture of his philosophy and his chief thoughts as the circumstances will allow ; our aim has been throughout to separate all which is strictly his own from the thoughts and the systems of other writers with which, of necessity, he had to deal. The task has been by no means easy, as his thoughts are often most subtly interwoven with the thoughts of others ; this is equally true of all his works. Indeed, such fault as we have to find with Dr. Caird, is just this, that he fails often to do justice to himself ; many of his finest and most original thoughts are not only scattered throughout his writings, but hid away in obscure corners and out-of-the-way places, like rare botanical specimens, hard to find ; but when found, are in their way priceless gems. This fault no doubt is largely the fault of his position, and must to some extent militate against all true philosophers ; for a true philosopher, if he is to help forward the march of mind, must himself be in the apostolic succession ; he must stand upon the shoulders of others and study their systems with the eyes of others. In short, the words of Green applied to Kant, that "he read Hume with the eyes of Leibniz, and Leibniz with the eyes of Hume," and was therefore "able to rid himself of the pre-suppositions of both and to start a new method of philosophy ;" is a conception, which Dr. Caird adapted, generalised, and applied all round. Indeed, he himself says of Plato "that he entered upon the whole inheritance of Greek thought, and his idealism was the result of a syntheses of all the tendencies that show themselves in it," and, coming later, Dr. Caird has done for his own age what he maintains Plato did for his. Through all his writings he constantly insists that, so long as there is an unexpressed thought which is latent beneath the expressed thought, and which secretly governs it, so long we have the right to criticise the expressed thought by bringing into prominence its implicit pre-suppositions. He sees God in all things, "the good in evil and the hope in ill success ;" that is to say, the Higher Unity which transcends difference, in the Deeper Identity of the finite and the Infinite underlying the finite personality with its relatively independent and self-determined life, and thereby lends the warrant of philosophy to Tennyson's otherwise paradoxical "Infinite Personality"—which is neither more nor less than Dr. Caird's highest conception, "Absolute

Individuality." We are justified in saying that Dr. Caird has been the medium of gathering together the diffracted rays and made it possible once again to see the pure white light of truth. If it had not been given to him as it has been given to few to take a great step forward, he has at least held the ground, and prepared the way for further progress. And if the next great advance of philosophy be made by one of his disciples he would doubtless consider that he has had his reward. Be that as it may, his circle of readers who find in his books the reconciliation of philosophy and poetry, of the literature of science, and the literature of sentiment and reflexion, will grow, while his old students when they meet will not cease to allude to him in reverent undertones as an instructor who, not less through the magnetism of his personality than by discipline in the art to think, profoundly influenced their lives.

FRIDAY, FEBRUARY 21ST, 1908.

Some British Echinoderms,

BY
ED. CONNOLD., F.Z.S., F.E.S.

THIS lecture was illustrated with 50 lantern slides especially photographed by the lecturer from natural and living echinoderms.

Many of the views were photo-micrographs of the structure of these animals and of various organs attached to them.

In his lecture Mr. Connold treated of the following:—The *Ophiuroidea*, or Snake tails—The *Holothuroidea*, or Sea-Cucumbers—The *Spatangoidea*, or Heart-Urchins—The *Echinidae*, or Sea-Urchins—The *Astroidea*, or Starfishes—Elucidation of the term *Echinodermata*—All British Echinoderms are marine—Slow in movement—Immense variety of interest in their structure and economy—The quinqueradial symmetry—Their habits and modes of life—The larval condition—Respiratory organs—Locomotion factors—The water-vascular system—The nervous system—The skeletal framework—The mandibulatory apparatus—The various foods—The test, and its growth—The Periproct—The Peristome—The ambulacral areas—The interambulacral areas—The Madreporite, and its function—The Spines, their mode of attachment and rotatory power—The Pedicellariæ: their forms, actions and functions—The Pseudopodia—The Ambulacræ—The Acetabulæ.

FRIDAY, MARCH 6TH, 1908.

English Gothic Architecture,

BY

MR. T. A. COYSH, L.D.S.

Illustrated with Lantern Slides.

PHOTOGRAPHIC illustrations of some of the most beautiful examples of ecclesiastical buildings were shown to the members by Mr. T. A. Coysh, L.D.S., who delivered a lecture on the four periods of English Gothic Architecture. While Mr. Coysh was by no means technical, he succeeded in very clearly defining the points of difference between the Norman, Early English, decorative English, and perpendicular periods. Roofs, pillars, doors, and windows were all brought under comparative observation during Mr. Coysh's interesting survey, and the large audience carried away delightful memories of the exquisite views of cathedrals and churches which were projected by the lantern. They were artistically charming, as well as conveying their architectural lesson, and afforded an intimate insight into the beauty which so abounds in often unheeded details of construction and ornament. Selby Abbey, Ely Cathedral, and St. Alban's Cathedral yielded some of the most notable of the evening's views. Mr. Coysh did not show any slides of Sussex churches, but was able, of course, to tell his audience of the opportunities of studying the Gothic styles, presented by a wealth of material in the surrounding churches. He was enthusiastically thanked on the motion of the President (Mr. G. Morgan), seconded by Mr. Leeney.

FRIDAY, MARCH 20TH, 1908.

Mr. D. E. Caush, L.D.S., gave a very interesting and instructive demonstration of the Projecting Microscope.

A paper, contributed by Dr. A. E. Edwards (U.S.A.), on the Geological Formation of the Land near Newport, was also read.

FRIDAY, APRIL 17TH, 1908.

Brighthelmstone—Brighton,

BY

MR. W. HARRISON, D.M.D.

Lantern Lecture.

THE history of Brighton in pictures might well have been the sub-title of the interesting lecture which was given by Mr. Walter Harrison, D.M.D. There are not many men who know so much about the history of Brighton in its olden days as Mr. Walter Harrison, following as he does close upon Mr. J. G. Bishop and one or two others who stand in the front rank of the chroniclers of Brighton, and probably only Mr. Harrison has the equipment for a lantern lecture on "Brighthelmstone—Brighton." For many years past it has been the hobby of Mr. Harrison, not only to compile information relating to the town, but to collect pictures that would illustrate its past history, and to turn them into lantern slides. The result is that he has now a unique collection of lantern slides relating to Brighton, and he was able to show upwards of 160.

It might fairly be said that he gave an illustrated history of Brighton from prehistoric days, for one of the earliest pictures shown was of the amber cup now in the Museum, found in the grave of some Brighton potentate of the Bronze Age. Pictures of the ancient British camp at Hollingbury and of the Goldstone stone recalled evidences of days when the inhabitant of Brighton probably wore little else than a coat of blue paint and a bone in his ear, and on his walks abroad carried a business-like piece of chipped flint tied in a stick, to hammer fraternal greetings in the skull of his neighbour. From these times of legend and supposition, it was a long leap to that quaint map which depicts the French attack on the town in the fifteenth century. Whether the date was 1514 or 1545 (as was discussed recently in the *Herald*) Mr. Harrison did not seem to dogmatise. Then he came to a prized possession, a picture of Brighton dated 1720, showing a few houses clustered on white cliffs doing duty for the Front, with St. Nicholas on a hill away out in the country in the background.

In those days Brighton had not realised its possibilities in the way of Metropole or Grand Hotels. Mr. Harrison quoted the Rector of Buxted who wrote in 1736 :—"I fancy the architects

here surely take the altitude of the inhabitants, and lose not an inch between the head and the ceiling. . . . But as lodgings are low, they are cheap." He could get practically a furnished house for 5s. a week. "The coast," the Rector added, "is safe; the cannons are all covered with rust and grass; the ships moored; and no enemy apprehended. Come and see." Here indeed was an early unsolicited testimonial to the future Queen of Watering Places.

Another side of the question came later. Among the tit bits of information that Mr. Harrison gave of Brighthelmstone in these days was that the vane on the Church of St. Nicholas, always lone and solitary in the pictures of the period, was in the shape of a gilt fish, probably a dolphin. But some fifty years after the Rector of Buxted praised the cheapness of Brighton's lodgings, the town had grown less unsophisticated, and had realised what it could do in the way of profiting from visitors. And Mr. Harrison had found this apostrophe to the vane of St. Nicholas, conceived by a plundered visitor to be a "shark," the emblem of Brighton.

"Say why, on Brighton's Church we see
 The golden shark display'd,
But that 'twas aptly meant to be
 An emblem of its trade.
Nor could the thing so well be told
 In any other way;
The town's a shark that lives on gold,
 The company its prey."

Another interesting point made by Mr. Harrison was that in the eighteenth century Brighton seems to have practised a certain amount of socialism,—or co-operation,—for its hemp shares, fields for the growing of hemp between Ship-street and Black Lion-street, were owned in common, and the profits shared among the townsmen. This was that Arcadian time when the Lanes were really lanes between fields, and not between lines of stuffy tenements devoted to the second-hand trade.

The main part of the lecture was concerned with the development of Brighton in the days when it began to realise its importance as a watering place and to cover its fields with the close-set houses that are the despair of landlords and property agents in these modern days of different ideas. Mr Harrison had a remarkably extensive collection of slides showing the older streets of Brighton in all stages of their development. He had views of the Steine when it was practically an open field, when, if you looked north, you saw the grass-clad downland of Round Hill,—now a prosaic aggregation of roofs and chimneys. North Street, East Street, West Street, were all shown, as by constant growth they evolved from scattered cottages to stately business thoroughfares, contracting to mere lanes in the improvidence of the first

half of the nineteenth century that cost so much in improvements and widenings to the latter half and to the twentieth century. A picture was shown of North Street when its rateable value was £26 ! For every sovereign it produced then, it yields a thousand to-day.

Dealing with the history of West Street, Mr. Harrison threw the weight of his authority in favour of the tradition that Charles II. did stop at the King's Arms, on the site of the existing building.

In regard to the official history of Brighton, a picture was shown of the first "town house" mentioned in 1558,—the year of the accession of Queen Elizabeth. It was built adjoining the block house, and was a circular building with a "dungeon" underneath. "Dungeon," by the way, is possibly a picturesque term for a cell ; one can hardly imagine Brighton with mediæval dungeons. A picture of the Town Hall of 1727, on the site a little to the north-west of the present building, revealed a gabled structure, unpretentious, but rather picturesque, with the poor house a little to the north. The poor house has had many migrations before it crystallised in the huge barracks "on the hill." Bartholomews seems in these early days to have been common land. One wonders how it got into private hands.

Concerning the name of the town, Mr. Harrison found it as "Brithampton" in early Tudor days. It remained Brighthelmstone to a comparatively late date. In the charter of incorporation of 1854, it is described as the "Parish of Brighton, otherwise Brighthelmstone." The older name, remarkable to relate, is still in official use. How many people know of the fact which Mr. Harrison learned from the Town Clerk, that to this day in the County Voters' Lists the parish is described as "Brightelmstone"?

Among other subjects that Mr. Harrison dealt with was the coaching industry. He had a picture of the first "coach" that was used in Brighton. This was practically a sedan chair on wheels, being pushed and pulled along by men. This elementary equipage was contrasted with the present day electric tram. The first record of a coach between London and Brighton he had found was in 1780. In 1822 there was no less than 68 coaches running between London and Brighton, and 1,200 horses were employed. The "Item" four-horse coach did the journey in the respectable time of three hours forty minutes.

Among the numerous items of curious information was this : that the present Church of St. Stephen was at one time the ball room of the Castle Hotel. Before being a ball room it was used for the Royal Chapel. The Wagner family rescued it from its secular use and had it transferred to its present site and re-consecrated.

The lecture also included pictures of the various schemes for

gardens, winter and others, from the Chalybeate to the Casino. What he thought of this last scheme Mr. Harrison would not venture to say.

The lecture was under the auspices of the Society, but, having realized its exceptional interest to the public, the Director of the Library, Mr. H. D. Roberts, secured it as one of the lectures associated with that institution, and thus gave it the wider public audience, which it deserved.

FRIDAY, MAY 1ST, 1908.

Forty Years of Bee-Keeping,

BY

MR. B. LOMAX.

Illustrated by Living Specimens and Appliances.

THE experiences that Mr. Benjamin Lomax has gained in forty years of bee-keeping were made the subject of a highly interesting lecture to the Society. Any subject that Mr. Lomax touches he makes interesting, and he compressed a remarkable amount of entertaining and instructive information in the course of his pleasantly delivered, chatty address. So far was the lecture removed from the conventional that Mr. Lomax brought with him a hive full of live bees, and passed it round among the audience, just to show them what a harmless creature the bee is when properly treated. In the old days you armed yourself with gloves and a veil when you went honey gathering, and you suffocated your bees. Now Mr. Lomax takes off his coat and rolls up his sleeves, and would no more think of suffocating the bees than he would of cutting down an apple tree to get at the apples. They used to suffocate the bees, though, in the days when he first saw the inside of a hive, and that was 62 years ago in Tasmania. Then honey-collecting was a tragedy. The 40 years ago, when Mr. Lomax first started bee keeping, was when he was surveying in the bush in Victoria. They found a large swarm of bees there and hived them in a tea chest. If they wanted honey they blew in a puff of smoke, and took what they could before the bees recovered from their fright. As Mr. Lomax showed, it is

still by frightening the bees that one nowadays gets honey without danger. You blow smoke into the hive, and you shake it. The bees, with the instinct of their primitive forest life, get terribly frightened ; and fright leads them to cluster together and try to get upwards. So if you frighten them into an inverted hive, they cluster despairingly inside the top. And Mr. Lomax sent round the inverted hive with the frightened bees inside.

Among the more interesting things Mr. Lomax had to say about bees was to point out that they have women's suffrage and nothing for the men. The female bee does all the work and has all the power, and,—a point to be noted in these days of suffragettes,—the rule of the females is peculiarly ruthless. As soon as the queen bee begins to lose her power of laying the full number of eggs, as soon as the poor males are found to be eating more than they seem worth, out the females turn them to perish of exposure. Thus ruthlessly are the principles of social economics carried out under feminine rule.

The superstitions that gather round bees were also told entertainingly by Mr. Lomax. The bee must be treated as one of the family. If a death occurs in the family the hive must be decorated with black ; if a wedding, with white. Should the mother of the family be dead, someone must go after dark, knock at the hive, and tell them. Bees greatly object to being bought and sold, and the buyers and sellers must be careful never to let them see the money. The money, too, must be gold. If these and other rules are broken the bees will be insulted, and will fly away. As a scientist, of course, Mr. Lomax had his explanation for these beliefs, and he showed how the natural habits of the bees would give rise to these fanciful ideas. Wherever the Celtic race is, one finds these ideas. They are strong in Brittany.

In Sussex, if a swarm of bees comes to a hive, they have to be propitiated with an offering of beer and sugar, with leaves of scarlet runners. It is undoubtedly an expression of thankfulness at the arrival of a piece of uncommon good fortune.

As the fruits of a long and discerning experience, Mr. Lomax had many other things of interest to say about bees, and he kept his audience thoroughly entertained.

WEDNESDAY, JUNE 10TH, 1908.

Annual General Meeting.

REPORT OF THE COUNCIL

FOR THE YEAR ENDING JUNE 10TH, 1908.

The Council made mention of the fact that this was the 54th year of the Society, and had pleasure in stating that the meetings during the year had been well attended. In addition to the inaugural address delivered by Mr. Morgan as President, twelve lectures and papers, most of which were illustrated with lantern slides, were given during the session.

The thanks of the Council were due to the Corporation for the permission given to the Society to hold its meetings in future in the Public Library, Museum, and Art Galleries. In the Curator's room of that building, prior to the alterations, the Society formerly held its meetings, and the Society's library had for many years been housed there.

The thanks of the Society were also due to the Establishment Sub-Committee and to the Chief Librarian, Mr. Roberts, for the arrangements made in reference to this change of meeting place. Mr. Robert Morse, the Society's Hon. Librarian, had intimated his desire not to seek re-election. The best thanks of the Society were due to him for his work as Hon. Librarian for several years past, and the valuable services he had rendered to the Society in that capacity.

The practice of the Society in having an annual excursion and dinner, which for some years previously had been in abeyance, was revived and proved very enjoyable. The thanks of the Society were due to Mr. Henry Davey for the excellent arrangements he had made in reference to this and many other of the Society's excursions, as well as to all who had in any way aided the Society in its excursion arrangements. It was gratifying to record that the excursions generally had been numerously attended.

The Treasurer's financial statement for the year shewed a balance in hand of £2 3s. 6d. There were a few outstanding liabilities, but on the other hand some subscriptions had not yet been paid. There had been an increase in the Society's receipts during the year, but the expenditure also had largely increased. There had been a slight increase in the membership of the Society, which now stood at 145 members and four associates, instead of 140 members and one associate at the beginning of the session.

The Council regretted to have to record the fact that one of the founders and original members of the Society, Mr. Barclay Phillips, had died. The only other surviving founder was Mr. George de Paris, who was to be proposed as an hon. member of the Society.

The Hon. Librarian's report showed that the number of books issued to members during the year had been 59, and the library had, as heretofore, been available to the general public for purposes of reference.

The following are the titles of the papers contributed during the past Session :—

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| 4th Oct., 1907. | "Function and Fatigue." |
| | By Dr. GEORGE MORGAN, L.R.C.P., F.R.C.S.(E). |
| 1st Nov., 1907. | "Weather Forecasting." |
| | By Mr. W. MARRIOTT, F.R.M.S. |
| 15th Nov., 1907. | "A Year and a Half with Savages." |
| | By Mr. A. H. DUNNING, F.R.G.S. |
| 6th Dec., 1907. | "Restocking of Flora and Fauna." |
| | By Mr. H. DAVEY. |
| " " " | "Autochrome Plates." |
| | By Dr. W. A. POWELL, M.R.C.S., L.R.C.P. |
| " " " | "Colour Photography." |
| | By Mr. OTTO PFENNINGER. |
| 10th Jan., 1908. | "British Orchids." |
| | By Mr. H. EDMONDS, B.Sc. |
| 7th Feb., 1908. | "Caird's Idea of Criticism." |
| | By Rev. Dr. JEFFREY JOHNSTONE. |
| 21st Feb., 1908. | "Some British Echinoderms." |
| | By Mr. ED. CONNOLD, F.Z.S., F.E.S. |
| 6th Mar., 1908. | "English Gothic Architecture." |
| | By Mr. T. A. COVSH, L.D.S. |
| 20th Mar., 1908. | "Projecting Microscope." |
| | By Mr. D. E. CAUSH, L.D.S. |

- 20th Mar., 1908 "Kettle-Holes."
 By Dr. A. E. EDWARDS (U.S.A.).
- 17th April, 1908. "Brighthelmstone—Brighton."
 By Mr. W. HARRISON, D.M.D.
- 1st May, 1908. "Forty Years of Bee-Keeping."
 By Mr. B. LOMAX.

The following is a list of the Excursions and Visits to places of interest during the past year, viz. :—

- 29th June, 1907. Chanctonbury Ring.
 6th July, 1907. Lewes over the Downs to Mount Caburn.
 20th July, 1907. Annual Excursion and Dinner.
 21st Sept., 1907. Ditchling Common.
 26th Oct., 1907. Corporation Meteorological Station.
 24th Jan., 1908. *Brighton Herald*.
 19th Feb., 1908. Reason's Manufacturing Works.
 14th Mar., 1908. Hanningtons, Ltd.
 26th Mar., 1908. Goldstone Bakeries.
 11th April, 1908. Lewes—Priory—Newmarket Hill.
 30th May, 1908. Glynde.
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HON. LIBRARIAN'S REPORT, JUNE 10th, 1908.

The number of Books issued out of the Library to Members during the year has been 59, and the Library has, as heretofore, been available to the general public for the purposes of reference.

Reports and proceedings of various other Societies with which the Society exchanges publications have also been received.

The following Books have been purchased during the year, viz. :—"Microscopy" and "Photo Micrography," by Dr. E. Spitta, F.R.A.S.

The following Serials have been purchased, bound and added to the Library, viz. :—

Annals of Botany.	Journal of Botany.
Zoologist.	Nature.
Entomologists' Monthly Magazine.	Geological Magazine.
	Entomologist.

ROBERT MORSE,
Hon. Librarian.

The Field Excursions and Visits to Factories.*

SATURDAY, JUNE 29TH, 1907.

TO CHANCTONBURY RING.

A remarkably successful outing, the Downs showing at their greatest beauty. Yet just at that time darkness and a very heavy storm fell upon London and nearly all the rest of the country. Steyning Church was first visited; then, while some ladies remained in the valley to botanise, the rest of the party took the path by the White Horse Hotel to the Downs and on to Chanctonbury Ring. So delicious was the air on the hills that the Simple Life was longingly talked of; and on the return there was a discussion as to whether Sussex is not after all the most beautiful county in England.

SATURDAY, JULY 6TH, 1907.

From Lewes over the Downs to Mount Caburn, in conjunction with the Archaeological Club. Afterwards to Glynde.

SATURDAY, JULY 20TH, 1907.

Revival of the Annual Outing and Dinner. See page 61.

SATURDAY, SEPTEMBER 21ST, 1907.

TO DITCHLING COMMON.

The rare orchid "lady's tresses" (*Neottia spiralis*) was discovered. Some of the party walked back over Ditchling Beacon in the harvest moonlight.

* Founded on the reports in the local Press.

SATURDAY, OCTOBER 26TH, 1907.

A VISIT TO THE CORPORATION METEOROLOGICAL STATION.

At the Town Hall the members were received by the Medical Officer of Health, Dr. Newsholme. He gave a detailed and most interesting account of the daily work accomplished, which requires the entire time of one clerk, furnishing full particulars to the Meteorological office, as well as to the local and the London Press. Accounts of abnormal rainfalls were stated ; and some members recalled the reports furnished during many years to the *Brighton Herald* by "Revilo" (Oliver) and to the *Sussex Daily News* by the late F. E. Sawyer, before the Corporation register was begun in 1877. More than two inches fell in one day during 1902 ; but a member present could recall the flooding of Pool-valley in 1850. Dr. Newsholme gave a highly lucid and interesting description of the apparatus employed for the various objects ; and then led the way to the Old Steine, where the rain-gauge is kept. By an ingenious artifice, when one-hundredth of an inch has accumulated the bulb tilts and makes a mark on the prepared paper. The new wind-gauge is now fixed.

Dr. Morgan, the Society's President, in appreciative language, proposed a hearty vote of thanks to Dr. Newsholme for his entertaining and instructive address and exhibition. Dr. Harrison seconded, and the vote was carried with enthusiasm. Finally, some of the party,—the ladies naturally refraining,—returned to the Town Hall and made the ticklish climb up the ladder which leads on to the roof. Here they inspected the sunshine recorder. This is a solid ball of glass which concentrates the sun's rays on a long bow-shaped card ; and as the sun moves on the rays burn a mark along the card, which is graduated in accordance with the hours of the day, varying for the seasons.

FRIDAY, JANUARY 24TH, 1908.

A VISIT TO THE PRINTING WORKS OF THE "BRIGHTON HERALD."

The newspaper was being printed at the time, and the actions of the linotype and of the folding machines were examined and explained. In thanking Mr. Attwick, the proprietor, for his kindness in giving the Society this opportunity, the President said that the members had had a most interesting experience, and that

the knowledge they had derived as to how the paper is produced would add to the gratification with which they would receive their *Herald* week by week. Dr. Morgan's remarks were enthusiastically applauded by the party.

WEDNESDAY, FEBRUARY 19TH.

VISIT TO REASON'S MANUFACTURING WORKS, LEWES ROAD.

A large party enjoyed an instructive insight into the making of electricity indicators, meters and arc lamps. The manufacture of these and kindred articles involves a big mechanical equipment, and the visitors had the advantage of seeing something of all the processes of casting, drilling, turning, planing, fitting together, and testing which contribute to the production of these electrical accessories. The construction of the ingenious mechanism which automatically switches on electric current at the required moment was another interesting detail, but most absorbing of all was the blowing of the complicated glass tubes used in the indicators and meters. The contrivance for drawing glass tubes out to the required gauge, in lengths that made one tremble for the fate of the tube, was a centre of fascination that the visitors are not likely to forget. The battery room in which the current is received from the Corporation mains in accumulators for distribution over the factory; the carpenters' shop—an important department; and the big saw mill were other features included in the tour of inspection. Subsequently, Mr. Henry Davey conveyed the thanks of the members to Mr. H. F. Reason, who briefly acknowledged the compliment.

SATURDAY, MARCH 14TH.

A TOUR THROUGH THE PREMISES OF HANNINGTONS, LTD.

A tour through the extensive premises of Hanningtons, Ltd., by kind permission of Mr. S. Hannington, J.P. The tour lasted some two and a half hours, and even that length of time proved barely sufficient for a thorough inspection of the vast range of shops, offices and show-rooms in North Street and East Street. The furnishing department was made the starting point of the

expedition, and here the party was received by Mr. Isaac Wells, at whose invitation the visit was made, and who took upon his shoulders the arduous duties of conductor. Mr. Wells extended a very hearty welcome to the visitors on behalf of Mr. Hannington, and also conveyed to them the latter's regret that he was unable to be present. He went on to mention the interesting fact that this is the centenary year of the foundation of the firm. The actual business, he said, was established in 1806 by two brothers named Constable, who walked all the way from Horley to Brighton to do so. In 1808 the grandfather of Mr. S. Hannington, the present managing director, purchased it, and the Constables went back to Horley in the same way that they came, namely, by walking. Such was the beginning of the undertaking whose name is now a household word throughout such a wide district. The brothers Constable subsequently crossed to America and established what is now one of the largest drapery businesses in New York City, Arnold, Constable and Co.

"AN ALPINE EXPEDITION."

The party then set out upon their tour which, considering the amount of climbing that had to be accomplished, was not inaptly compared with an Alpine expedition. After a glance at the complete and up-to-date stock of ironmongery, some time was spent in inspecting the rooms in which the furniture is housed. The show-room on the first floor was found to be occupied by arm-chairs and couches of every imaginable shape, and upholstered in the latest and most artistic designs. The ladies of the party were unable to resist the temptation to test personally some of the more inviting looking specimens. In other rooms, drawing and dining room furniture of many periods and styles were passed in review, and in the upper regions the visitors were shown how carpets are planned to fit the rooms of the purchaser and the sections then sewn together by means of a special sewing machine. When the rear of the North-street premises was reached Mr. Wells reminded the party that they were standing upon the site of the old Brighton Athenæum, where the Rev. F. W. Robertson, Sir John Cordy Burrows, and other by-gone worthies delivered addresses in the early half of the last century. Passing through the carpet department, what are known as the Pavilion dormitories were reached. These were the sleeping apartments of the Royal servants in the days when George IV. held his Court at the Royal Pavilion, and they still remain very much as they were then. At the present moment their use is not very far removed from their original purpose, for they are occupied by ranks upon ranks of brass bedsteads, dressing tables, wardrobes, and other examples of bedroom furniture.

A BEWILDERING TOUR.

Having exhausted the attractions of the premises on the northern side of North Street, the party crossed the road and examined the premises in which the estate agency and undertaking branches of the business are carried on. Then, passing through the extensive auction rooms, they found themselves in Brighton Place, where their attention was drawn to the premises in which the furniture repository branch of the business was started. The contrast between these and the fine buildings in D'Avigdor Road, Hove, furnishes a striking proof of the enormous extent to which this development of the undertaking has grown. Near by, overlooking a pleasant enclosed garden, are the quarters of the male employees of the firm, for whose recreation a well-appointed billiard room, a comfortable reading room and a library are provided. Passing through Market Street, the premises assigned to the ladies engaged in the business were reached, and the large, well-lighted and brightly furnished dining room and drawing room, overlooking Castle Square, were much admired. Then followed a bewildering tour through suites of magnificent show rooms, labyrinths of corridors and innumerable staircases, till all sense of locality was lost, and the visitors hazarded wild guesses as to their whereabouts. The ladies and gentlemen's outfitting department, the trunk department, the household linen department, the cloth department, and the mantle and costume show rooms, were passed in review, and a peep was also afforded at the offices and counting house. Most of the party also ascended to the famous clock which overlooks Castle Square, and whose familiar chimes have kept a great part of Brighton informed of the time of day for over forty years. The end of their pilgrimage left the party amazed, and to some extent bewildered, by the greatness of the interests which centre in the North Street and East Street premises. Tea had been thoughtfully provided, and afterwards Mr. Henry Davey proposed a hearty vote of thanks to the Directors of Hanningtons, Limited, for their kind permission to view the premises, to Mr. Isaac Wells for his kind invitation and for personally conducting the party over the establishment, and to Mr. and Mrs. Clewer (Mr. Wells' son-in-law and daughter), who superintended the refreshments. Mr. Davey said the members of the Society had already visited several establishments, but he did not know that they had ever been more interested than on the present occasion. The motion was carried with acclamation, and, in reply, Mr. Wells said there might be very little natural history in shop-keeping, but there was the philosophical side, and the Society owed a good deal to the shop-keeper.

THURSDAY, MARCH 26TH.

A VISIT TO GOLDSTONE BAKERIES.

By the kind invitation of Mr. J. J. Clark, Alderman and J.P. of Hove, the Goldstone Bakeries, Fonthill-road, Hove, were visited to examine the new system of automatic bread-making, by which the whole of the operations from start to finish are carried out by machinery. Alderman Clark conducted the party, and explained the successive stages in the process, as follows:—(1) The sifting of the flour and the kneading of the dough by machinery; (2) the cutting of the dough by an ingeniously designed "dough divider" into equal pieces of the exact size for making two-pound loaves, the pieces being then passed on to a shaping and moulding machine; (3) the automatic conveyance of the shaped pieces to the "proving cupboard" which contains trays travelling slowly through it, the temperature encouraging the function of the yeast in producing a light loaf; (4) the automatic passage of the "proved" dough from the "proving cupboard" to the second moulding machine where the dough is finally shaped and moulded ready for baking; and finally (5) the cooking of the bread in the steam-pipe ovens fired by fuel gas. The "handing up" and moulding plant is an ingenious machine effecting a result which is the equivalent of hand moulding. The dough is introduced between a trough and a revolving table at a point on its outer periphery. The table is sharply "coned" and imparts just as much or as little "working" as may be required by the dough to be treated. The automatic "proving" apparatus is equally ingenious, and consists of an inclosed structure containing swinging trays carried on continuous chains. The chains move intermittently, the speed being regulated in such a manner as to cause the loaves to remain in the "prover" just so long as is necessary to obtain the exact amount of "proof" required. The result is to secure a complete uniformity of treatment and a uniformly standard product. Finally, the ovens are fired by means of gaseous fuel. The gas is taken directly from the furnace to the ovens, where its combustion is very simply regulated beneath a row of tubes. There is thus neither a boiler nor gas holder employed. The entire installation was designed by Messrs. Werner, Pfleiderer and Perkins, Limited, bakery engineers, of Peterborough. Not only is the bread preserved, as far as it is possible to preserve it, from human contamination, but the surroundings in which it is produced keep clean, wholesome and sanitary.

Light refreshments were hospitably served during the evening.

DR. HARRISON'S HOPE.

At the close of the demonstration Dr. Harrison voiced the thanks of the party to Alderman Clark for his kindness. "We have carefully inspected the bakeries, and the clean and sanitary manner in which everything is conducted must have appealed to all of us. (Applause.) More especially I noticed the fine physique of the men who are employed in this trying work. We thank you also for allowing us to sample the 'specimens,' which we thoroughly enjoyed. (Applause.) On behalf of the members of this Society I record our sincere thanks for your kindness in permitting us to come here, and also for taking us round and showing us this up-to-date, scientific, sanitary bakery." (Applause.)

Expressions of appreciation and thanks also came from Mr. Isaac Wells. It had been said, he observed, that "the man is a benefactor to his race who makes two blades of grass grow where only one grew before." They had seen something of the efforts of Alderman Clark in connection with the ground round there; what he had been able to get out of the ground was most astonishing. (Hear, hear, and applause.) He joined heartily in thanking Alderman Clark for affording them the opportunity of seeing this latest development in hygienic bread-making. His (Alderman Clark's) reputation had evidently gone far and wide. He incidentally mentioned that some friends who recently visited the Goldstone Bakeries were talking about it in Scotland and advising some of their friends, when they retired, to come to reside in this neighbourhood, where they could see bread baked in the most scientific and cleanly manner. (Applause.)

In acknowledgment, Alderman Clark said it gave him very great pleasure to see people going round and taking such an interest in all the various kinds of machinery. It was a source of gratification to him to find his efforts to produce "the staff of life" under the very best hygienic conditions were so much appreciated. "And," he added, "I think now we have got to such a pitch we may almost say we have arrived at the very perfection of hygiene so far as bread-making is concerned." (Applause).

This concluded what was voted one of the most interesting and enjoyable excursions in the annals of the Society.

SATURDAY, APRIL 11TH, 1908.

EXCURSION TO LEWES.

VISITING THE PRIORY AND NEWMARKET HILL.

By kind permission of Mr. F. G. Courthope, J.P., the ruins of the once great Priory were thrown open to the members. An account of the ancient building was given by Mr. Frederick Harrison. Taking his stand near the spot where the envoys from De Montfort and the Barons at Fletching offered terms to Henry III, Mr. Harrison told his hearers that so effective had been the destruction of the Church in the time of the dissolution of monasteries by Henry VIII., that the only vestige which remained was a few stones, and not until the railway was cut in 1845 was even the site known. The present ruins were chiefly the remains of the domestic offices.

THE GUNDRADA CHAPEL.

The original building, dedicated to St. Pancras, and begun in 1077 and added to up to 1500, must have been in extent and beauty equal to any of our modern cathedrals. It must have been similar to the present monastery of Cluny, in France. The grounds covered 40 acres. The party, having inspected the ruins, adjourned to the Church, and at the invitation of the Rector, the Rev. Harcourt S. Anson, inspected the Gundrada Chapel and tomb. Here Mr. Harrison explained that the Chapel was a good specimen of modern Norman work. The slab in the centre had been taken to Isfield at the dissolution of the monastery, and kept there for about two centuries. When, however, the remains of William de Warrenne and Gundrada were unearthed during the railway excavation in 1845 they were deposited in the Chapel built for the purpose, and the slab was returned by Sir Walter Burrell. The party having expressed thanks to Mr. Courthope and the Rector's son, Mr. Wilfrid Anson, who conducted them to the chapel, returned to Brighton, the majority walking to Falmer over Newmarket Hill.

SATURDAY, MAY 30TH, 1908.

A TRIP TO GLYNDE.

About fifty members and friends visited Glynde by the kind invitation of the Hon. Frances Wolseley, who met them at the Church. The Rev. W. E. Dalton, M.A., conducted them round the edifice, which was built by Bishop Trevor in 1765, and possesses the characteristic features of the period, which, though said to have been admired when finished, are not so at the present day. Glynde Place was thrown open to the visitors by the kindness of — Beckwith-Smith, Esq., and some time was passed here in admiring the splendid suite of rooms with their fine pictures, carving, and metal work. Thence the members passed to the Dairy, and finally visited the School for Lady Gardeners, of which the Hon. Frances Wolseley is the Principal.

The School was founded in 1901-2, and is supervised by the Hon. Frances Wolseley. The number of Students is limited and great care is taken as to their selection. A personal interview and the highest references are required before admission. The following arrangements for the course of work are a development upon specialised lines of the scheme which has up to now existed. The chief object of the course is to give a thorough foundation in the management of all the more hardy garden plants and to improve taste in the laying out and arrangement of gardens.

Attention is given to the every-day work of a garden, comprising:—The care of grass, paths and beds; mowing, sweeping, and general tidiness; digging, trenching, and other ground operations, raising plants from seeds and cuttings, their subsequent treatment; culture of herbaceous, alpine plants and roses; forcing violets, Dutch bulbs, richardias, etc.; watering, ventilation, and other points of glass house management. Gathering and packing flowers and general varieties of vegetables for market is carried out. Fruit is grown, including bush, standards, espaliers, and strawberries.

Arrangements are made by which students can visit local gardens. They are required to keep notes of these visits and to answer in (writing) questions upon them. The advantages thus gained to students, in comparing their own work with that of those having life-long experience, will be a special feature of the school.

Students are encouraged to stay two years if it is found that their special needs can be provided for. In any case they should not stay less than one year. Advice is given as to their future.

At the conclusion of the visit, on the motion of Dr. Walter Harrison, a hearty vote of thanks was given to the Hon. Frances Wolseley and Miss Campion. Some members, after tea at Glynde, walked by the road to Lewes; others mounted the hills and enjoyed a glorious walk in the evening light.

Revival of the Annual Outing & Dinner.

TUESDAY, JULY 23RD, 1907.

"I have never had a happier, pleasanter, or more instructive day." In thus testifying to his appreciation of the proceedings, Dr. G. Morgan (President) voiced the unanimous opinion of those members who participated in the Annual Outing of the Society, which was revived—after a lapse of 15 years—with the happiest results. Leaving Brighton at 10.13, the party proceeded to Uckfield, where they boarded chars-a-banc for a long drive through the beautiful scenery for which Ashdown Forest is justly famous. Passing first through Maresfield, they turned off the high road at Lampool Gate, and traversed the hamlet of Fairwarp ; and then the road begins to rise sharply, as the ironsand of the elevated moorland is entered. Nature has distinctly separated this tract from the surrounding country. Oldlands was seen on the right, and at Duddleswell the top of the ridge was attained, Crowborough coming into view to the north-east. The views here are magnificent, but the day was too misty. Camp Hill is over 700 feet above the sea, and it only needed the sunshine to make the prospect a vision of perfect beauty, but the mist, in perpetual obstinacy, still enshrouded the far-away hills. A little farther and the country was like a lofty Scottish moor. The land was bare of trees for some distance, but the heather was just bursting into its purple blossom, and the bracken gave promise of luxuriant growth. Once a beautiful valley burst into view, waking in one's mind visions of a happy idleness that might be spent there on a future holiday. And a little later there was a fascinating glimpse of the entrance to another valley, exactly like a Devonshire coombe, and you involuntarily looked for the blue sea flowing at the end in brilliant contrast against the green of the trees, as you find it in the Shire of the Sea Kings ; but there was only that eternal gray mist hemming in the horizon with a spiteful persistence that would have made you savage—if you had not been a philosopher.

Onward again, and a little way to the right as the road forked the party passed near a big clump of trees known by the curious name of King's Standing. King Edward II. often used to visit Ashdown Forest, where he had a hunting lodge ; and it is thought that the place derived its name from the fact that he used to stand there while the deer were driven by him. A more interesting explanation, as mentioned by Mr. Davey, is furnished by an

old legend, the belief in which was persisted in for a long time. This was that in 1264 King Henry III. stood and watched the Battle of Lewes from that point, where, being fifteen miles away from the scene of the conflict, he thought he would be in perfect safety ! At Kidd's Hill the road drops suddenly in a series of steep descents suggestive of a switchback ; and here the party alighted and plodded cheerfully on foot till level ground was reached once more. At the bottom of the hill Mr. Davey called a halt and gave an instructive little roadside talk on Ashdown Forest and its historic associations. Vast expanses of the Forest are quite bare of trees ; and Mr. Davey called attention to the fact, which is not always understood, that a forest is not necessarily a wood, but a tract enclosed for the chase, and often is mainly moorland. Such are Ashdown Forest, Woolmer Forest in Hampshire, and Dartmoor Forest ; and in political life we speak of the Commissioners of Woods *and* Forests. Mr. Davey was doubtful whether the Forest is in the same condition as it was in Roman times, although he believed there was more wood a hundred years ago than there is to-day. Some people have thought that a great number of the trees have been used as fuel for the iron-furnaces of the district.

After briefly touching upon the geographical and geological characteristics of the Forest, and mentioning that the Romans appeared to have carried on the ironworks at Oldlands, Mr. Davey proceeded to state that it was known that Edward II. frequently visited it, and that he built the old Palace which formerly stood in Vetchery Wood. The Forest, or, as it was called, the Free Chase, or Lancaster Great Park, was granted to John of Gaunt in 1372, and it was of great value by reason of the wood, the deer, and the iron mines. The diary of Henslow (the contemporary of Shakespeare) whose father was a Forest keeper, was written on the flyleaves of a book used for keeping accounts relating to the timber. During the Civil War, however, the pale by which it was enclosed appeared to have been broken down, and the deer were killed. A survey made by the Earl of Pembroke in 1658 showed that there were almost exactly 14,000 acres. At the Restoration the Forest was granted to the Earl of Bristol ; but then trouble with the foresters arose, and, added Mr. Davey, that had continued until the present day. The foresters claimed *estover*, the right of taking wood for any absolutely necessary purpose. In conclusion, he remarked that the last deer was supposed to have been killed in 1808, but he had been informed that there were still some left on the Forest, perhaps even a hundred.

The journey was then resumed, a feeder of the Medway being crossed, and another ascent began on the way to Coleman's Hatch ; and here a turn was taken to the west, skirting Ashdown

Park, and through a vast avenue of splendid fir-trees, lifting their proud heads as tall and straight as a regiment of telegraph poles. At Wych Cross, which is 658 feet above sea-level, another turn was made, this time to the south along a glorious descent which goes straight as an arrow to Chelwood Gate and beyond,—a road which must be an irresistible temptation to all mad motorists and cyclists who suffer from the speed fever. At Chelwood Gate there was a welcome halt for the horses, and a stroll among the heather was delightful. Mr. Davey showed how suddenly the ground rises as the forest land begins. The drive was resumed to Nutley, where there was a halt for tea; and as plenty of time remained before dinner, it was decided to drive to Buxted, and walk through the Park. There a splendid avenue of lime-trees diffused a delicious perfume sweeter than jasmine; and the beautiful deer and the fine black cattle watched in lazy contemplation. But there are laws as rigorous and unchanging as those of the Medes and Persians against loitering in Buxted Park; and so this scene of sylvan beauty, worthy of the best traditions of a county rich in noble demesnes, had to be left behind all too soon.

And now the philosophers remembered that they get hungry, like other folk; and hied them to the Maiden's Head Hotel, Uckfield, for dinner. The dinner was like the hotel itself—old-fashioned, and British, and good; and it was a very cheerful company that sat down to the tables under the Chairmanship of the new President, Dr. Morgan. Alderman Colbatch Clark, Hon. Secretary of the Society, was in the vice-chair. No toast list had been arranged; but the President very properly felt that the company could not separate without passing a cordial vote of thanks to Mr. Henry Davey for the excellent arrangements he had made for a very pleasant excursion, and for the instructive lecturette which he gave en route.

Mr. Davey's health was drunk with much cordiality; and in reply he said how glad he was to find that the excursion had been so much appreciated. He was very pleased to know that the revival of the excursion had been so successful. Mr. Davey mentioned that since the last annual excursion was held, fifteen years ago, the Society had been considerably changed by the admission of lady members; and he was glad to find that this departure had been to the advantage of the Society in every way. (Applause.)

The health of the ladies was therefore drunk, and the Rev. W. T. Mackintosh replied on their behalf; after which a similar compliment was paid to the President, on the invitation of Alderman Clark.

The journey to Brighton concluded a thoroughly successful outing.

COUNTY BOROUGH OF BRIGHTON.

METEOROLOGICAL STATION.

LATITUDE $50^{\circ} 49' 15''$ N. LONGITUDE $0^{\circ} 8' 10''$ W.

The Barometer, a Fortin pattern, is fixed near the doorway of the front entrance to the Town Hall. The height of the cistern of the Barometer above the Mean Sea Level is 48ft.

The following Thermometers are in a Stevenson Screen on the Old Steine, one Maximum, one Minimum, one Dry Bulb and one Wet Bulb. There are also a Minimum Thermometer on the Grass, and a 4ft. Earth Thermometer.

The Rain Guage is a 5in. Snowdon Pattern, and is situated near the Stevenson Screen. The height of the Rain Guage above the Mean Sea Level is 32ft. There is also an Automatic Rain Guage, this records the amount and duration of rain.

The Anemometer is a Dine's Pressure Anemometer and is kept at the Tower, of Tower House, Sussex Street, which is situated on the crest of the hill.

The Sunshine Recorder, a Campbell Stokes Instrument, is situated on the roof of the Town Hall. This instrument records only the bright sunshine.

METEOROLOGY OF BRIGHTON.

MONTH.	TEMPERATURE OF AIR DURING MONTH.			WIND.			RAINFALL.			SUNSHINE from 1890.		
				Number of Days of			Number of Days on which Rain fell			Number of Sunless Days recorded.		
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.			
July,	1907	58.8	74	3	2	2	3	3	14	2	2	229.67
"	1877-1907	61.8	76	2	-	1	1	2	13	12	12	239.19
August,	1907	60.4	76	4	7	7	2	1	1	1	1	203.00
"	1877-1907	46.5	62.0	75	-	2	1	1	13	12	12	218.10
September,	1907	59.4	42.7	57.4	83	2	-	4	3	6	6	186.65
"	1877-1907	76.6	35.9	58.4	47.8	88	4	2	1	3	3	172.03
October,	1907	33.2	35.7	53.5	11	11	16	16	16	16	16	87.73
"	1877-1907	62.8	29.5	51.9	25	16	16	16	16	16	16	115.43
November,	1907	58.0	35.7	46.3	11	11	16	16	16	16	16	76.84
"	1877-1907	63.5	17.9	32.1	11	11	17	17	17	17	17	71.47
December,	1907	54.9	17.6	48.3	85	2	2	1	1	1	1	60.68
"	1877-1907	69.4	17.6	41.5	85	4	5	4	1	1	1	106.35
January,	1908	49.9	20.5	37.9	85	6	6	6	1	1	1	88.47
"	1877-1907	63.6	12.0	40.0	85	15	15	15	15	15	15	60.73
February,	1908	54.9	28.9	41.8	87	2	2	1	1	1	1	92.32
"	1877-1907	58.0	17.4	40.8	87	7	7	9	9	9	9	83.89
March,	1908	50.3	28.3	40.7	84	5	4	4	12	11	11	129.23
"	1877-1907	65.0	20.2	42.9	84	5	4	4	14	11	11	135.70
April,	1908	59.6	32.3	45.1	77	6	8	1	1	1	1	116.34
"	1877-1907	75.4	28.0	47.4	84	1	2	1	1	1	1	176.78
May,	1908	72.2	40.1	54.0	84	1	2	1	1	1	1	206.17
"	1877-1907	80.8	30.0	53.0	73	7	6	-	3	1	1	225.92
June,	1908	52.0	41.5	60.2	59.0	11	11	11	1	1	1	235.51
"	1877-1907	85.0	37.0	-	-	11	11	11	1	1	1	221.93
Entire Year	...	82.0	20.6	50.5	81	42	43	27	38	19	44	1762.61
Average of Years 1877-1907	...	...	...	50.4	163	28.11	28.11	147	147	163	63	1772.46

BRIGHTON & HOVE NATURAL HISTORY & PHILOSOPHICAL SOCIETY.

Treasurer's Account for the Year ending 10th June, 1908.

Dr.	£ s. d.	Cr.	£ s. d.
To Balance in the hands of the Hon. Treasurer, 6th June, 1907	22 2 8	By Books and Periodicals	£ 6 19 9
" Annual Subscriptions to 1st October, 1907	15 0 0	" Bookbinding	1 18 3
" Annual 1st October, 1908	54 5 0	" Printing Annual Report and Abstract of Proceedings	14 8 6
" Associates Subscriptions "	0 7 6	" Printing and Advertising	10 7 9
" Dividends on £100 2½ per cent. Consols for one year	2 10 0	" Stationery	1 12 1
"		" Postage	10 8 3
"		" Societies	1 6 2
"		"	2 2 0
" Commission to Collector	" " "	"	2 15 3
" Hire of Rooms for Meetings	" " "	"	3 17 0
" Lecturers' Fees and Expenses	" " "	"	15 8 0
" Hire of Lantern, Operator's Charges and other Expenses of Meetings	" " "	"	14 0 9
" Expenses of Excursions, Gratuities, etc.	" " "	"	16 1 0
" Insurance of Books	" " "	"	1 1 0
" Case for Botanical Specimens	" " "	"	0 5 0
" Cheque Book	" " "	"	0 1 0
" Balance	" " "	"	2 3 6
			<u>£94 5 2</u>
Balance brought forward	" " "		" " "
			2 3 6

NOTE.—There is a sum of £100 2½ per cent. Consolidated Stock standing in the names of Mr. JOHN COLBATCH CLARK and Mr. E. ALLOWAY PANKHURST, who hold this as Trustees for the Society.

HERBARIUM.

The following plants have been added to the Herbarium since the last report, in 1904. They were all collected in Sussex :—

<i>Lonicera xylosteum.</i>	Wilmington, East Sussex.
<i>Valeriana dioica.</i>	Poynings.
<i>Botrychium Lunaria.</i>	Newtimber Hill.
<i>Rapistrum perenne.</i>	Black Rock, Brighton.
<i>Festuca ciliata.</i>	Brighton.
" "	Newhaven.
<i>Acer campestre, b. leiocarpon</i>	Wolstonbury Hill.
<i>Festuca ambigua.</i>	Canal Bank, Southwick.
<i>Atropa Belladonna</i>	Newtimber.
<i>Alopecurus bulbosus.</i>	Lancing.
<i>Glyceria Borreri.</i>	Lancing.
<i>Parietaria fallax.</i>	Kingston-by-Lewes.
<i>Coronilla varia.</i>	Black Rock.
<i>Prunella laciniata.</i>	Roedean, Rottingdean.
<i>Arenaria tenuifolia.</i>	Ladies' Mile, Patcham.
<i>Salvia verticillata.</i>	Warren Farm.
<i>Carex Boenninghausiana.</i>	Henfield.
<i>Erysimum perfoliatum.</i>	Kemp Town Slopes.
<i>Sisymbrium pannonicum.</i>	Newhaven.
<i>Sisymbrium Austriacum.</i>	Newhaven.
<i>Verbascum Blattaria.</i>	Newhaven.
<i>Apera Spica-venti.</i>	Newhaven.
<i>Delphinium consolida.</i>	Newhaven.
<i>Erigeron canadense.</i>	Newhaven.
<i>Filago spathulata.</i>	Telscombe.
<i>Ajugo chamæpitys.</i> New to Sussex ?	Downs East of Newhaven.
<i>Scutellaria galericulata, x. minor.</i>	Ditchling Common.
<i>Chenopodium glaucum.</i> New to Sussex ?	Fulking.
<i>Reseda gracilis ?</i>	Goldstone Bottom.
<i>Dipsacus laciniata.</i>	Old Shoreham Road.
<i>Atriplex Babingtonii, var. virescens.</i>	Kingston-by-Sea.
<i>Viola hirta, f. lactiflora</i>	Newmarket Hill, Rotting-dean.
<i>Draba muralis.</i>	Arundel.
<i>Erophila stenocarpa.</i>	Greatham, West Sussex.
<i>Viola Riviniana, b. nemorosa.</i>	Newtimber.
<i>Medicago tribuloides.</i>	Shoreham Beach.
<i>Lepidium virginicum.</i>	By the Basin, Aldrington.
<i>Arenaria serpyllifolia, b. glutinosa.</i>	Shoreham Beach.
<i>Anthemis tinctoria, v. discoidea.</i>	Hodshrove Farm, Falmer.
<i>Potamogeton interruptus, b. scorpiarius.</i>	Litlington, East Sussex.
<i>Brassica elongata.</i>	Racehill, Brighton.

<i>Vicia gemella, var. tenuissima.</i>	Near Ringmer.
<i>Polypogon littoralis.</i>	Thorney Road.
<i>Statice rariflora, x. limonium.</i>	Bosham.
<i>Fumaria pallidiflora.</i>	Henfield.
<i>Rumex multifidus.</i>	Newhaven.
<i>Colchicum autumnalis.</i>	Chailey.
<i>Nasturtium officinale, e. microphyllum.</i>	Barcombe.
<i>Symphytum officinale, b. patens.</i>	Near Pulborough.
<i>Carduus acanthoides.</i>	Patcham.
<i>Pisum arvense.</i>	Aldrington.
<i>Vicia narbonensis.</i>	Aldrington.
<i>Vicia peregrina.</i>	Aldrington.
<i>Ranunculus fluitans.</i>	Western Rother.
<i>Thalictrum flavum.</i>	Amberley.
<i>Papaver somniferum.</i>	Standean.
<i>Sinapis dissecta.</i>	Saddlescombe.
<i>Lepidium perfoliatum.</i>	Roedean, Rottingdean.
<i>Dianthus prolifer.</i>	Newhaven.
<i>Silene Anglicana.</i>	Uckfield.
<i>Hypericum montanum.</i>	Stedham, West Sussex.
<i>Vicia gracilis.</i>	Cuckfield.
<i>Lathyrus sphaericus.</i>	Aldrington.
<i>Rubus carpinifolius.</i>	Small Dole, West Sussex.
<i>Rubus erythrinus, b. glandulosa.</i>	Patcham.
<i>Rubus rhombifolius.</i>	Street.
<i>Rubus robustus.</i>	Street.
<i>Rubus leptopetalus.</i>	Henfield.
<i>Rubus horridicaulis.</i>	Small Dole.
<i>Rubus adornatus.</i>	Chailey.
<i>Rubus divexiramus.</i>	Ambersham, West Sussex.
<i>Rubus minutiflorus.</i>	Cowdrey Park.
<i>Atriplex deltoidea, b. salina bab.</i>	Aldrington.
<i>Populus tremula.</i>	Plumpton.
<i>Arctium Newboldii.</i>	Newtimber.
<i>Salvia pratensis.</i>	Poynings.
<i>Plantago-arenaria.</i>	Southwick.
<i>Matricaria inodora, b. salina.</i>	Kingston Beach.
<i>Juncus tenuis.</i> First found in Sussex in 1906, by Mr. Druce.	Wood near East Hoathly. Near Midhurst.
<i>Anthoxanthum Puelii.</i>	Seaford. The only place known for it in the British Isles. Found by Mr. Thompson in 1906 ; apparently native.

RESOLUTIONS, &c., PASSED AT THE ANNUAL GENERAL MEETING,

Held June 10th, 1908.

The Reports and Treasurer's Account having been read, it was proposed by Mr. E. A. PANKHURST, seconded by Mr. A. W. CHALMERS PESKETT, and resolved—

“That the Report of the Council, the Treasurer's statement (subject to its being audited and found correct), and the Librarian's Report, be received, adopted, and printed for circulation, as usual.”

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year, viz. :—

“J. E. Haselwood, E. J. Petitfourt, B.A., F.C.P., F. Merrifield, F.E.S., D. E. Caush, L.D.S., A. Newsholme, F.R.C.P., J. P. Slingsby Roberts, W. Clarkson Wallis, J.P., E. Alloway Pankhurst, Henry Davey, Walter Harrison, D.M.D., George Morgan, L.R.C.P., F.R.C.S.”

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors, viz. :—

“Mr. A. F. Graves and Mr. Isaac Wells.”

It was proposed by Mr. ISAAC WELLS, seconded, and resolved—

“That the following gentlemen be Officers of the Society for the ensuing year, viz. :—*President*: E. J. Spitta, M.R.C.S., L.R.C.P., F.R.A.S.; *Ordinary Members of Council*: F. Hora, B.Sc., W. H. Payne, W. A. Powell, M.R.C.S., L.R.C.P., Edgar Duke, M.D., Robert Morse, A. W. Chalmers Peskett, M.A., M.B., B.C., Cantab; *Honorary Treasurer*: Douglas E. Caush, L.D.S.; *Honorary Librarian*: Henry D. Roberts; *Honorary Curators*: H. S. Toms and T. Hilton; *Honorary Scientific Secretary*: F. Harrison, M.A.; *Honorary Secretary*: Jno. Colbatch Clark; *Assistant Hon. Secretary*: Henry Cane.”

It was proposed by Mr. HENRY DAVEY, seconded by Mr. W. H. PAYNE, and resolved—

“That the best thanks of the Society be given to Mr. George Morgan, F.R.C.S., L.R.C.P., for his assiduous attention to the interests of the Society as President during the past year.”

It was proposed by Mr. A. W. CHALMERS PESKETT, seconded by Mr. GEORGE FORBES—

"That the sincere thanks of the Society be given to the Vice-Presidents, the Council, the Honorary Librarian, the Hon. Treasurer, the Honorary Curators, the Hon. Auditors, and the Honorary Secretaries for their services during the past year."

It was proposed by Mr. F. HARRISON, seconded by Mr. E. A. PANKHURST, and resolved—

"That Rule 11 (as to Associates) be rescinded."

A resolution moved by Dr. WALTER HARRISON affecting the Rules for Election of Members, and an amendment thereto moved by Mr. A. W. CHALMERS PESKETT, were both withdrawn, the question being left over for consideration by the Council.

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society.

Academy of Natural Sciences, Philadelphia, U.S.A.

British Association, Burlington House, Piccadilly.

Barrow Naturalists' Field Club, Cambridge Hall, Barrow-in-Furness.

Belfast Naturalists' Field Club, c/o G. Donaldson, 8, Mileriver Street, Belfast.

Belfast Natural History and Philosophical Society, The Museum, College Square, N. Belfast.

Boston Society of Natural Science (Mass, U.S.A.).

British Museum, General Library, Cromwell Road, London, S.W.

Cardiff Naturalists' Society, Frederick Street, Cardiff.

City of London Natural History Society.

Chester Society of Natural Science.

Croydon Microscopical and Natural History Club, Public Hall, Croydon.

Department of the Interior, Washington, U.S.A.

Edinburgh Geological Society, India Buildings, George IV Bridge.

Eastbourne Natural History Society.

- Epping Forest and County of Essex Naturalist Field Club, West Ham Institute.
- Folkestone Natural History Society.
- Geologists' Association.
- Glasgow Natural History Society and Society of Field Naturalists.
- Hampshire Field Club.
- Huddersfield Naturalist Society.
- London County Council, Horniman Museum.
- Leeds Naturalist Club.
- Lloyd Library, 224, West Court Street, Cincinnati, Ohio, U.S.A.
- Lewes and East Sussex Natural History Society.
- Liverpool University Institute of Commercial Research in the Tropics.
- Maidstone and Mid-Kent Natural History Society.
- Mexican Geological Institute, 5A, Del Cipres, No. 2,728 Mexico.
- Michigan University, Ann Arbor, Michigan.
- North Staffordshire Naturalists' Field Club, Stone, Staffs. (Wells Bladen, Secretary).
- Nottingham Naturalists' Society, University College, Nottingham.
- Peabody Academy of Science, Salem, Mass, U.S.A.
- Quekett Microscopical Club, 20, Hanover Square, London, W.
- Royal Microscopical Society, 20, Hanover Square, London, W.
- Royal Meteorological Society, Prince's Mansions, 73, Victoria Street, S.W.
- Royal Society, Burlington House, Piccadilly.
- Smithsonian Institute, Washington, U.S.A.
- South-Eastern Union of Scientific Societies.
- South London Microscopical and Natural History Club.
- Southport Society of Natural Science, Rockley House, Southport.
- Société Belge de Microscopie, Bruxelles.
- Tunbridge Wells Natural History and Antiquarian Society.
- University of Colorado, Boulder, Colorado.
- Watford Natural History Society.
- Woolwich District Antiquarian Society.
- Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton and Hove Natural History and Philosophical Society,

1808.



N.B.—Members are particularly requested to notify any Change of Address at once to Mr. J. C. Clark, 9, Marlborough Place, Brighton. When not otherwise stated in the following List the Address is in Brighton. Names printed in italics are Life Members.



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GRINSTEAD, W. F. H., 13, Powis Square.

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PESKETT, GUY, Simla, Clermont Road.
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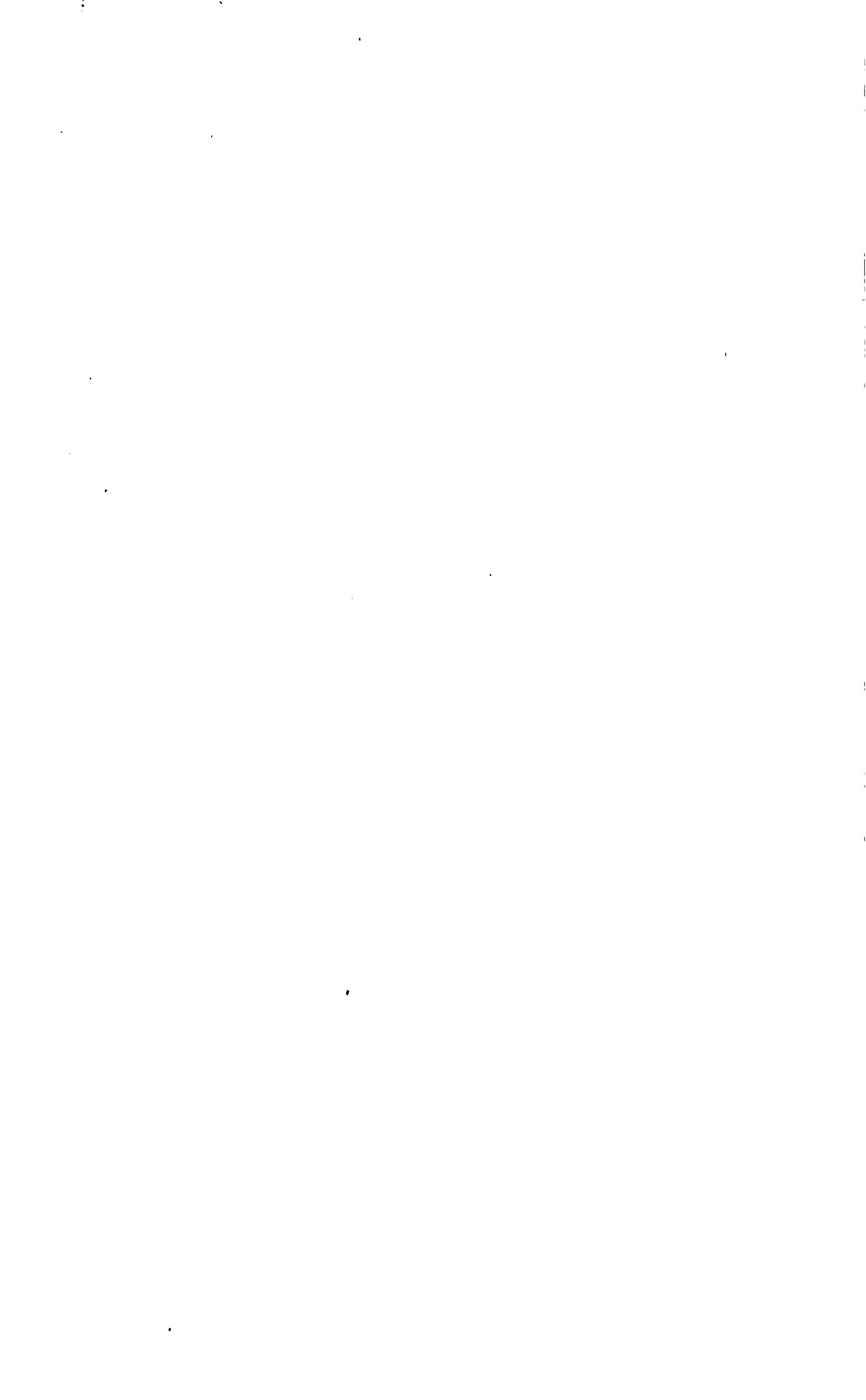
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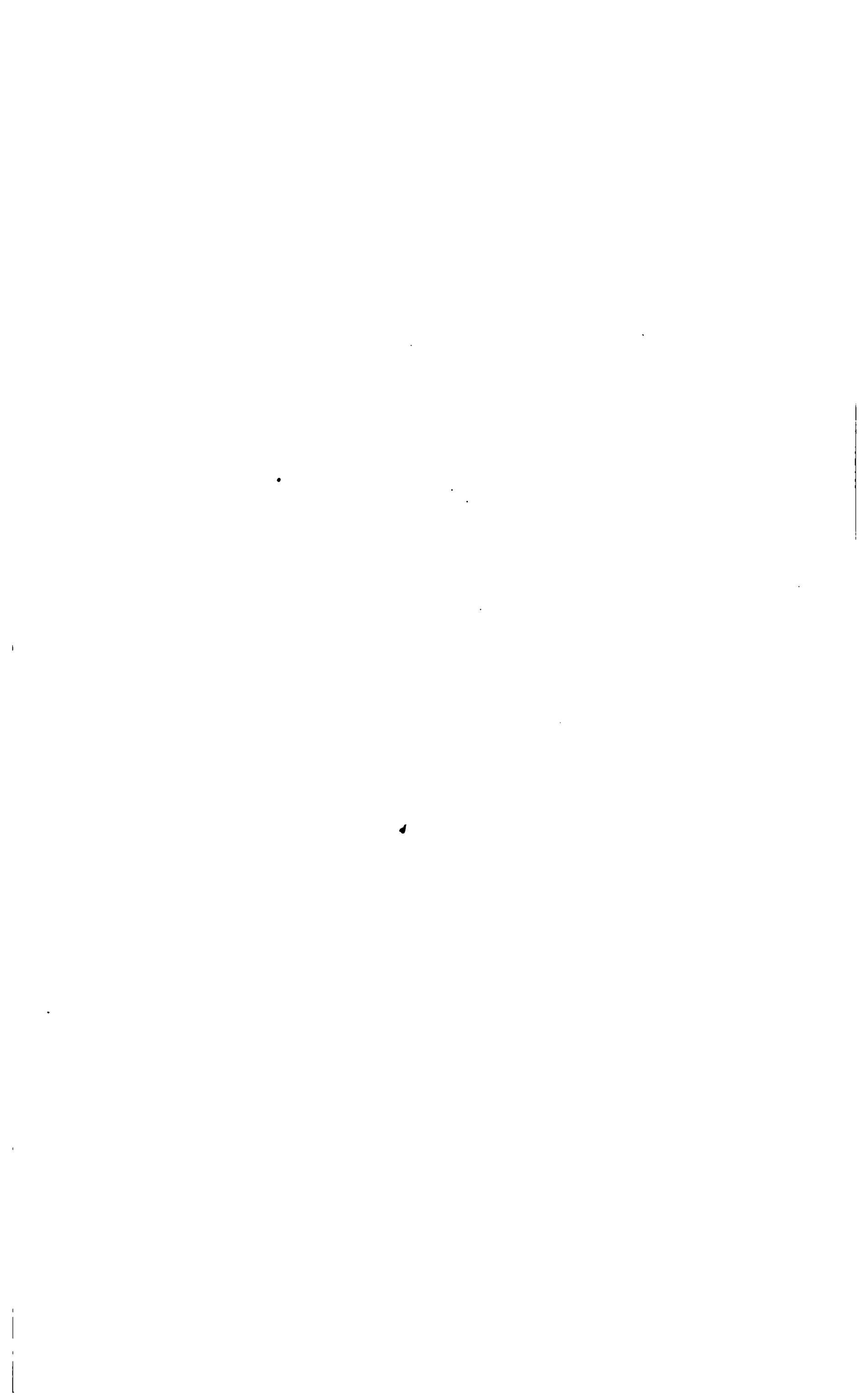
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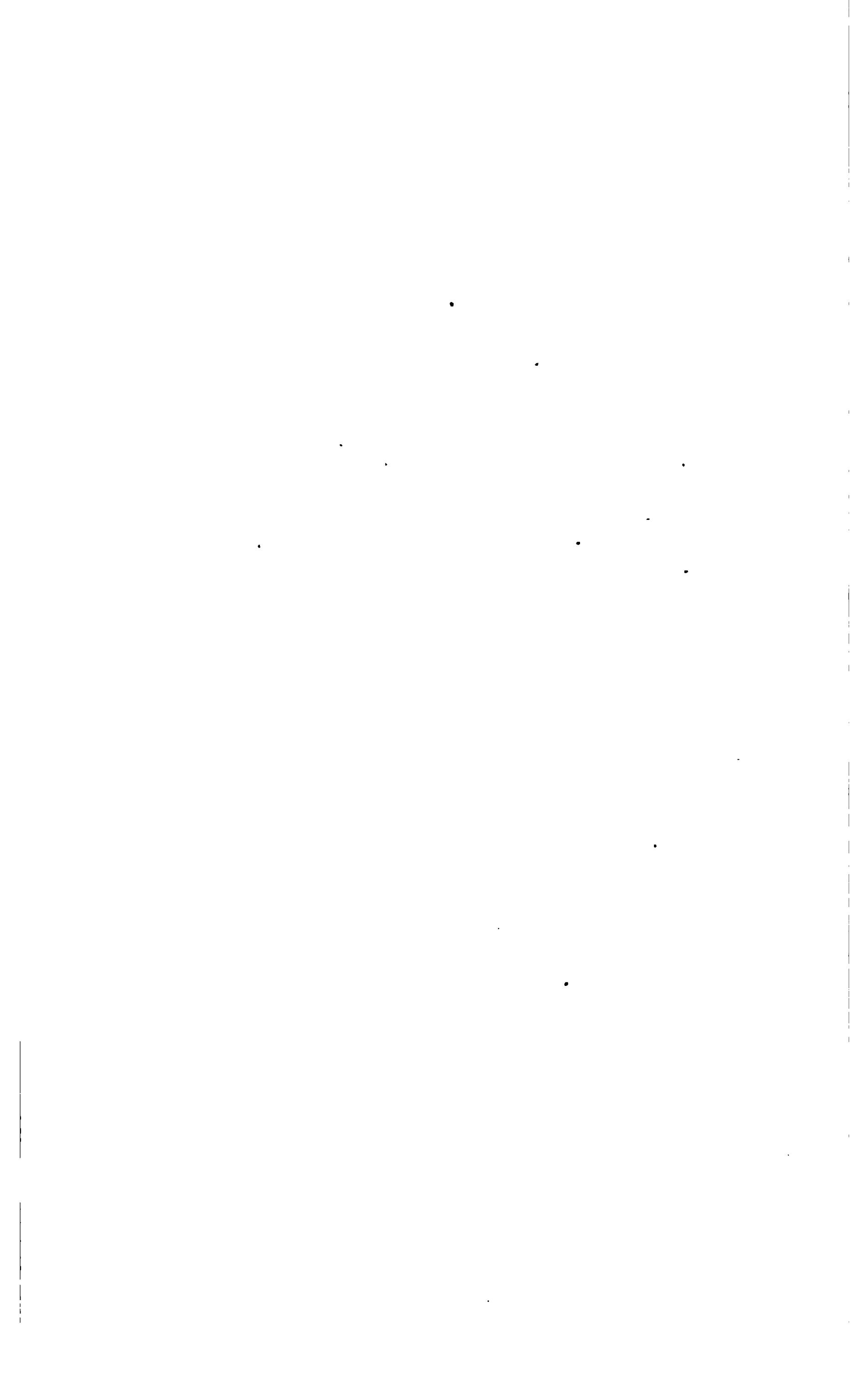
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